TRANSACTIONS
OF THE
PHILADELPHIA
ACADEMY
OF
SURGERY

VOL. XVII.

1915

TRANSACTIONS

OF THE

PHILADELPHIA

ACADEMY OF SURGERY

VOLUME XVII

PHILADELPHIA
PRINTED FOR THE ACADEMY
1915

NOTICE

The present volume of *Transactions* contains the papers read before the Academy from January, 1914, to December, 1914, inclusive.

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LIPPINCOTT PRESS, PHILADELPHIA

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1880 THOMAS G. MORTON
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1904 JAMES P. HUTCHINSON
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1880 JOHN ASHHURST, JR.
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1895 HENRY R. WHARTON

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1898 THOMAS R. NEILSON
1900 W. JOSEPH HEARN
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1880 JOHN H. PACKARD

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1894
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JOHN ASHHURST, JR.
WILLIAM W. KEEN

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WILLIAM W. KEEN

1902–1904
WILLIAM J. TAYLOR
WILLIAM L. RODMAN
JOHN B. ROBERTS

1900–1901
WILLIAM W. KEEN
J. EWING MEARS
J. CHALMERS DACOSTA

1905
WILLIAM J. TAYLOR
DEFORREST WILLARD
RICHARD H. HARTE

1910
WILLIAM J. TAYLOR
RICHARD H. HARTE
JOHN H. GIBBON

ACTIVE FELLOWS OF THE PHILADELPHIA ACADEMY OF SURGERY

1910.* Alexander, Emory G., M.D., 1627 Oxford Street. Clinical Professor of Surgery in the Woman's Medical College; Demonstrator of Fracture Dressings at the Jefferson Medical College; Surgeon to the St. Christopher's Hospital; Associate Surgeon to the Episcopal Hospital; Assistant Surgeon to the Kensington Hospital for Women; Surgeon to the Out-Patient Department of the Mary J. Drexel Home for Children.

1905. Allen, Francis Olcott, Jr., M.D., 2216 Walnut Street. Assistant Surgeon to the Bryn Mawr Hospital; Dispensary Surgeon to the Presbyterian, Pennsylvania, and Children's Hospitals.

† Allis, Oscar H., M.D., 1604 Spruce Street. Consulting Surgeon to the Presbyterian Hospital.

1906. Ashhurst, Astley P. C., M.D., 811 Spruce Street. Instructor in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases; Associate Surgeon to the Episcopal Hospital.

1898. Boger, John A., A.M., M.D., 2213 North Broad Street. Surgeon to the St. Mary's and Stetson Hospitals; Surgeon to the Dispensary of the Episcopal Hospital.

1905. Brooks, Macy, M.D., 1321 Spruce Street. Assistant Genito-Urinary Surgeon to the Philadelphia Hospital.

* Figures denote year elected to membership.
† Denotes Original Fellows.

1907. CARMANY, HARRY S., M.D., 366 Green Lane, Roxborough. Surgeon to St. Timothy's Hospital; Out-Patient Surgeon to the Episcopal Hospital.

1909. CARNETT, JOHN B., M.D., 123 South 20th Street. Associate in Surgery in the University of Pennsylvania; Chief Surgeon to the American Stomach Hospital; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the University Hospital; Consulting Surgeon to the Phœnixville Hospital and to the Phipps Institute.

1896. DACOSTA, JOHN CHALMERS, M.D., 2045 Walnut Street. Samuel D. Gross Professor of Surgery in the Jefferson Medical College; Consulting Surgeon to the Philadelphia Hospital.

1896. DAVIS, GWILYM G., M.D., M.R.C.S. (Eng.), 1814 Spruce Street. Professor of Orthopædic Surgery in the University of Pennsylvania; Chief Surgeon to the Widener Memorial Industrial School; Surgeon to the Orthopædic Hospital; Consulting Surgeon to St. Joseph's Hospital.

1896. DEAVER, HENRY C., M.D., 1415 N. Broad Street. Professor of Surgery in the Woman's Medical College; Surgeon to the Episcopal Hospital, to the Kensington Hospital for Women, and to the Children's Hospital of the Mary J. Drexel Home.

1890. DEAVER, JOHN B., M.D., 1634 Walnut Street. Professor of the Practice of Surgery in the University of Pennsylvania; Surgeon-in-Chief to the German Hospital; Surgeon to the University Hospital.

1908. DESPARD, DUNCAN LEE, M.D., 1806 Pine Street. Demonstrator of Clinical Surgery in the Jefferson Medical College; Associate in Gynæcology in the Philadelphia Polyclinic; Surgeon to the Abington Hospital; Assistant Surgeon to the Jefferson Hospital.

1884. DULLES, CHARLES W., M.D., 4101 Walnut Street. Consulting Surgeon to the Rush Hospital.

1909. ELMER, WALTER G., M.D., 1801 Pine Street. Instructor in Orthopædic Surgery in the University of Pennsylvania; Surgeon to the Pennsylvania Training School for Children at Elwyn; Orthopædic Surgeon to the Jewish Hospital; Assistant Orthopædic Surgeon to the University Hospital.

1898. FRAZIER, CHARLES HARRISON, M.D., 1724 Spruce Street. Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Episcopal, and Philadelphia Hospitals.

1899. GIBBON, JOHN H., M.D., 1608 Spruce Street. Professor of Surgery in the Jefferson Medical College; Surgeon to the Pennsylvania and Bryn Mawr Hospitals.

1914. GILL, A. BRUCE, M.D., 318 South 15th Street. Orthopædic Surgeon to the Abington Hospital; Assistant Surgeon to the Presbyterian and Orthopædic Hospitals; Assistant Surgeon to the Widener Memorial Industrial School for Crippled Children; Assistant in the Orthopædic Department of the Episcopal Hospital.

1914. GINSBURG, NATHANIEL, M.D., 1704 Pine Street. Associate in Surgery in the Philadelphia Polyclinic; Instructor in Anatomy in the University of Pennsylvania; Surgeon to the Jewish Hospital; Assistant Surgeon to the Mt. Sinai Hospital.

1902. GIRVIN, JOHN H., M.D., 2120 Walnut Street. Associate in Obstetrics in the University of Pennsylvania; Gynæcologist to the Presbyterian Hospital.

1892. HARTE, RICHARD H., M.D., 1503 Spruce Street. Associate Professor of Surgery in the University of

1910. LEE, WALTER E., M.D., 905 Pine Street. Surgeon to the Glen Mills School; Assistant Surgeon to the Germantown Hospital; Gynæcologist to the Out-Patient Department of the Pennsylvania Hospital; Surgeon to the Dispensaries of the Episcopal, Bryn Mawr, and Children's Hospitals.

1899. LOUX, HIRAM R., M.D., 1614 N. Broad Street. Professor of Genito-Urinary Surgery in the Jefferson Medical College; Surgeon to the Philadelphia General Hospital.

1900. MARTIN, EDWARD, M.D., 1506 Locust Street. John Rhea Barton Professor of Surgery in the University of Pennsylvania; Professor of Clinical Surgery in the Woman's Medical College; Surgeon to the University of Pennsylvania and Howard Hospitals; Consulting Surgeon to the Bryn Mawr, Wernersville, and Norristown Hospitals.

1907. MILLER, MORRIS BOOTH, M.D., 2117 Pine Street. Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Surgeon to the Douglas Hospital.

1904. MITCHELL, CHARLES F., M.D., 332 South 15th Street. Surgeon to the Germantown and Bryn Mawr Hospitals; Surgeon to the Out-Patient Department of the Pennsylvania Hospital; Consulting Surgeon to the Eastern State Penitentiary.

1906. MÜLLER, GEORGE P., M.D., 1729 Pine Street. Professor of Surgery in the Philadelphia Polyclinic; Associate in Surgery in the University of Pennsylvania; Surgeon to the St. Agnes Hospital; Assistant Surgeon to the University Hospital; Consulting Surgeon to the Chester County Hospital.

1902. MUTSCHLER, LOUIS H., M.D., 2030 Tioga Street. Surgeon to the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital.

1905. NASSAU, CHARLES F., M.D., LL.D., 1831 Chestnut Street. Assistant Professor of Surgery in the Jefferson Medical College; Chief Surgeon to the Frankford Hospital; Surgeon to St. Joseph's Hospital; Assistant Surgeon to the Jefferson Hospital.

1890. NEILSON, THOMAS R., M.D., 1937 Chestnut Street. Professor of Genito-Urinary Diseases in the University of Pennsylvania; Emeritus Professor of Genito-Urinary Diseases in the Philadelphia Polyclinic; Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children.

1906. ‡NORRIS, HENRY, M.D., Rutherfordton, North Carolina.

1912. PFEIFFER, DAMON B., M.D., 2028 Pine Street. Instructor in Surgery in the University of Pennsylvania; Director of the Clinical Laboratory in the Presbyterian Hospital; Pathologist to the German Hospital; Surgeon to the Abington Memorial Hospital; Assistant Surgeon to the University Hospital; Assistant Surgeon to the Out-Patient Department of the German Hospital.

1890. ROBERTS, JOHN B., M.D., 313 South 17th Street. Professor of Surgery in the Philadelphia Polyclinic.

1898. ROBINSON, J. WIER, M.D., 326 South 16th Street.

1913. RODMAN, JOHN STEWART, M.D., 2106 Walnut Street. Assistant Professor of Surgery in the Medico-Chirurgical College; Assistant Surgeon to the Medico-Chirurgical Hospital; Surgeon to the Dis-

‡ Non-Resident Fellow.

pensary of the Presbyterian Hospital; Assistant Surgeon to the Out-Patient Department of the Pennsylvania Hospital.

1900. RODMAN, WILLIAM L., M.D., LL.D., 2106 Walnut Street. Professor of the Principles of Surgery and Clinical Surgery in the Medico-Chirurgical College of Philadelphia; Surgeon to the Medico-Chirurgical, Presbyterian, and Philadelphia General Hospitals.

1900. ROSS, GEORGE G., M.D., 1721 Spruce Street. Instructor in Surgery in the University of Pennsylvania; Surgeon to the Germantown and Stetson Hospitals; Assistant Surgeon to the German and University Hospitals; Surgeon to the Out-Patient Department of the German Hospital.

1913. RUGH, J. TORRANCE, M.D., 1616 Spruce Street. Associate in Orthopædic Surgery in the Jefferson Medical College; Orthopædic Surgeon to the Methodist and Philadelphia General Hospitals; Assistant Orthopædist to the Jefferson Hospital.

1894. SHOEMAKER, GEORGE ERETY, A.M., M.D., 1831 Chestnut Street. Gynæcologist to the Presbyterian Hospital.

1903. SITER, E. HOLLINGSWORTH, M.D., 1818 S. Rittenhouse Square. Instructor in Genito-Urinary Diseases in the University of Pennsylvania; Genito-Urinary Surgeon to the Philadelphia General Hospital; Chief Surgeon to the Out-Patient Department for Genito-Urinary Diseases in the University Hospital.

1913. SKILLERN, PENN GASKELL, JR., M.D., 241 South 13th Street. Instructor in Anatomy and Surgery in the University of Pennsylvania; Instructor in Surgery

in the Philadelphia Polyclinic; Assistant Surgeon to the Out-Patient Department of the University Hospital.

1909. SPEESE, JOHN M., M.D., 2206 Locust Street. Associate in Surgery in the Philadelphia Polyclinic; Instructor in Surgery and Surgical Pathology in the University of Pennsylvania; Surgeon to the Children's Hospital; Assistant Surgeon to the Presbyterian Hospital.

1898. SPELLISSY, JOSEPH M., A.M., M.D., 110 South 18th Street. Attending Surgeon to the Methodist Hospital; Attending Surgeon to St. Joseph's Hospital; Physician in Charge of Photo A Department in the University Hospital.

1911. STELLWAGON, THOMAS C., JR., M.D., 1831 Chestnut Street. Assistant Professor of Genito-Urinary Surgery in the Jefferson Medical College; Assistant Surgeon to the Philadelphia Hospital.

1903. STEWART, FRANCIS T., M.D., 311 South 12th Street. Professor of Clinical Surgery in the Jefferson Medical College; Surgeon to the Germantown Hospital; Surgeon to the Out-Patient Department of the Pennsylvania Hospital.

1908. SWEET, J. EDWIN, A.M., M.D., 301 St. Mark's Square. Assistant Professor of Experimental Surgery in the University of Pennsylvania.

1890. TAYLOR, WILLIAM J., M.D., 1825 Pine Street. Surgeon to the St. Agnes and to the Orthopædic Hospitals; Consulting Surgeon to the West Philadelphia Hospital for Women and to the Woman's Hospital.

1911. THOMAS, BENJAMIN A., M.D., 116 South 19th Street. Professor of Genito-Urinary Surgery in the Philadelphia Polyclinic and College for Graduates in

Medicine; Instructor in Surgery in the University of Pennsylvania; Surgeon-in-Chief to the Out-Patient Department of the University Hospital.

1911. THOMAS, THOMAS TURNER, M.D., 2005 Chestnut Street. Associate Professor of Applied Anatomy in the University of Pennsylvania; Associate in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia Hospital; Assistant Surgeon to the University Hospital.

1907. UHLE, ALEXANDER A., M.D., 1701 Chestnut Street. Assistant Instructor in the Genito-Urinary Department of the University of Pennsylvania; Assistant Genito-Urinary Surgeon to the Philadelphia Hospital; Surgeon to the Urologic Dispensary of the German Hospital.

1892. WHARTON, HENRY R., M.D., 1725 Spruce Street. Surgeon to the Presbyterian and Children's Hospitals and to the Girard College; Consulting Surgeon to the Bryn Mawr Hospital, St. Christopher's Hospital, and to the Pennsylvania Institution for the Deaf and Dumb.

1883. WHITE, J. WILLIAM, M.D., PH.D., LL.D. (Hon., Aberdeen), 1810 South Rittenhouse Square. John Rhea Barton Emeritus Professor of Surgery in the University of Pennsylvania.

1902. WHITING, A. D., M.D., 1523 Spruce Street. Instructor in Surgery in the University of Pennsylvania; Medical Director of the Germantown Hospital; Surgeon to the Germantown Hospital; Surgeon to the Southern Home for Destitute Children; Surgeon to the Home for the Training in Speech of Deaf Children; Assistant Surgeon to the German Hospital; Assistant Surgeon to the University Hospital; Surgeon to the Out-Patient Department of the German Hospital.

1890. WILSON, H. AUGUSTUS, M.D., 1611 Spruce Street. Professor of Orthopædic Surgery in the Jefferson Medical College; Emeritus Professor of Orthopædic Surgery in the Philadelphia Polyclinic; Orthopædic Surgeon to the St. Agnes Hospital; Consulting Orthopædic Surgeon to the Lying-in-Charity Hospital and to the Kensington Hospital for Women.

1898. WOOD, ALFRED C., M.D., 2035 Walnut Street. Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, Philadelphia, Howard, and St. Timothy's Hospitals; Consulting Surgeon to the Charity Hospital and to the State Hospital for the Insane, Norristown.

1910. WOODS, RICHARD F., M.D., 1501 Spruce Street. Assistant Surgeon to the Gynæcean Hospital.

1902. YOUNG, JAMES K., M.D., 222 South 16th Street. Professor of Orthopædic Surgery in the Philadelphia Polyclinic; Clinical Professor of Orthopædic Surgery in the Woman's Medical College of Pennsylvania; Associate Professor of Orthopædic Surgery in the University of Pennsylvania; Consulting Orthopædic Surgeon to the Women's Hospital of Philadelphia.

LIST OF FELLOWS WHO HAVE DELIVERED THE ANNUAL ADDRESS

1881. S. D. Gross.
1882. D. Hayes Agnew.
1883. William Hunt.
1884. John H. Brinton.
1885. John H. Packard.
1886. R. J. Levis.
1887. J. Ewing Mears.
1888. C. B. G. de Nancrede.
1889. John B. Roberts.
1890. De Forrest Willard.
1891. William G. Porter.
1892. T. G. Morton.
1893. C. W. Dulles.
1894. W. B. Hopkins.
1895. John B. Deaver.
1896. James M. Barton.
1897. Thomas R. Neilson.
1898. O. H. Allis.
1899. William J. Taylor.
1900. None.
1901. H. R. Wharton.
1902. J. M. Spellissy.
1903. R. G. LeConte.
1904. G. G. Davis.
1905. J. Chalmers DaCosta.
1906. Richard H. Harte.
1907. Edward Martin.
1908. Charles H. Frazier.
1909. John H. Gibbon.
1910. Astley P. C. Ashhurst.
1911. John H. Jopson.
1912. George G. Ross.
1913. Wm. L. Rodman.
1914. Alfred C. Wood.

WINNERS OF THE SAMUEL D. GROSS PRIZE

1895 "Inquiry into the Difficulties Encountered in the Reduction of Dislocations of the Hip."—Dr. Oscar H. Allis, Philadelphia, Pa.

1902 "The Treatment of Certain Malignant Growths by Excision of the External Carotids."—Dr. Robert H. W. Dawbarn, New York, N. Y.

1905 "The Biology of the Micro-organisms of Actinomycosis."—Dr. James Homer Wright, Boston, Mass.

1910 "An Anatomical and Surgical Study of Fractures of the Lower End of the Humerus."—Dr. Astley Paston Cooper Ashhurst, Philadelphia, Pa.

HONORARY FELLOWS

ELECTED.

1881 *Sir James Paget.....London, England.
1881 *Theodor Billroth.....Vienna, Austria.
1881 *Bernhard von Langenbeck. Berlin, Germany.
1881 *Willard Parker.....New York, N. Y.
1881 *Lewis A. Sayre.....New York, N. Y.
1881 *Moses Gunn.....Chicago, Ill.
1881 *John T. Hodgen.....St. Louis, Mo.
1881 *W. W. Dawson.....Cincinnati, Ohio.
1881 *T. G. Richardson.....New Orleans, La.
1881 J. Collins Warren.....Boston, Mass.
1881 *W. T. Briggs.....Nashville, Tenn.
1881 *Christopher Johnston.....Baltimore, Md.
1881 *D. W. Yandell.....Louisville, Ky.
1898 *Maurice H. Richardson.... Boston, Mass.
1898 George M. Sternberg.....Washington, D. C.
1898 *Charles B. McBurney..... New York, N. Y.
1898 *Nicholas Senn.....Chicago, Ill.
1898 *Theodore F. Prewitt.....St. Louis, Mo.
1898 L. McLane Tiffany.....Baltimore, Md.
1898 *Nathaniel P. Dandridge... Cincinnati, Ohio.
1898 *Roswell Park ..... Buffalo, N. Y.
1898 Robert F. Weir.....New York, N. Y.
1898 Frederick S. Dennis.....New York, N. Y.

* Deceased.

1900	W. H. A. Jacobson	London, England.
1900	Theodor Kocher	Berne, Switzerland.
1900	Vincenz Czerny	Heidelberg, Germany
1906	William J. Mayo	Rochester, Minn.
1906	Dudley P. Allen	Cleveland, Ohio.
1906	Robert Abbe	New York, N. Y.
1906	C. B. G. de Nancrede	Ann Arbor, Mich.
1907	*John C. Munro	Boston, Mass.
1908	J. Ewing Mears	Philadelphia, Pa.
1909	Stephen Pilcher	Brooklyn, N. Y.

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PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING, HELD JANUARY 5, 1914.

Dr. Gwilym G. Davis, President, in the Chair.

TUBAL PREGNANCY.

Dr. A. D. Whiting reported the following case:

L. L., a white female aged nineteen, was admitted to the Germantown Hospital, November 22, 1913. Her history states that she was married when 15 years of age and that she gave birth to a normal child 3 years ago. Her menstrual history dates back 7 years. Her menses were regular but very painful and the flow was always profuse. Her last menstrual period started April 7, 1913, and lasted 4 days, being normal in every respect. There has been no vaginal bleeding or discharge of any character since that time. She began to have the nausea and vomiting of pregnancy in May and also had pains in the lower abdomen which were intermittent in character. These were similar to pains she had had while carrying her first child, although she thought them more severe. Fetal movements had been felt for more than two months before admission and had been unusually severe and painful on the day of admission. The patient had noticed practically no difference between this pregnancy and her former one and had made arrangements for her delivery in January.

At 11 A.M., November 22, 1913, after returning home from shopping, she made and ate a sandwich which she says caused marked nausea followed by vomiting and retching and severe pains, of a lancinating character, in the lower abdomen. She became faint and felt very cold, weak, and thirsty. She drank considerable water, which she immediately vomited. The symptoms continuing, her physician, Dr. Sutliff, was called. He immediately sent her to the hospital as a case of concealed hemorrhage.

On admission, the lips and conjunctivæ were blanched, the skin was pale, the breathing was rapid and shallow, the pulse was

thready and too rapid to be counted accurately. Patient complained of extreme thirst, was very restless, and showed great excitement in her facial expression.

Examination revealed a large, rounded mass extending from the pubes to above the umbilicus slightly to the right of the median line. Percussion elicited dulness over the entire right side of the abdomen, present but not so marked on the left side. Vaginal examination revealed an enlarged uterus with a soft cervix. The fundus could not be distinguished; the uterus seemed to be continuous with the abdominal mass, which moved freely with the cervix. There was no vaginal discharge. No fetal movements could be felt; fetal heart sounds could not be heard. The temperature was 97° F.; respirations, 48; pulse rate approximately 160. A diagnosis of internal hemorrhage was made and immediate operation advised.

Operation at 3 P.M., November 22, within 4 hours after the onset of the alarming symptoms. Under ether anæsthesia, an incision was made through the right rectus. The right iliac fossa was filled with an enormous blood clot, while clots and fluid blood almost filled the peritoneal cavity. Rapid removal of the blood allowed an examination of the tumor which presented. It was found to be a globular mass springing, apparently, from the right broad ligament and containing a hard, irregular body. It was freely movable; there were no adhesions between it and any surrounding structure. On its surface were many broad, flat ribbon-like vessels, one of which was bleeding freely but without pulsation. The tumor was attached to the right broad ligament and to the right cornu of the uterus by a short portion of the right fallopian tube; the right ovary was to the right and below; the fundus of the uterus was below and to the left; both ovaries and the left tube were apparently normal. The right tube had apparently entirely disappeared in the tumor.

The broad pedicle of the tumor was ligated and the tumor removed. The abdomen was flushed with hot saline solution and the wound was closed in tiers without drainage. Two thousand c.c. of salt solution were given intravenously during the operation and one-half grain morphia was administered hypodermically.

The patient reacted well from the operation. Examination of the blood twenty-four hours after admission showed a hæmoglobin of 21 per cent.; red blood cells, 2,460,000; and white blood cells, 18,600. The temperature rose to 101.6° F. after the operation

and continued between 99.6° and 103° for 15 days, although no cause for the continued fever could be found. The wound healed without infection; the lungs remained normal; there was no cardiac complication; there was no phlebitis; there were no signs of peritonitis. Forty-eight hours after operation the patient expelled from the vagina a mass that seemed to be a cast of the inside of the uterus. With this exception, there was no uterine discharge. At 5 P.M. on the fifteenth day after operation the temperature was 103° F.; at 5 A.M. on the sixteenth day, it registered 98.6°, and remained between 98° and 99° until the patient was discharged from the hospital on the twenty-eighth day after operation.

The tumor weighed, immediately after operation, 3670 grammes and measured 68 cm. in its longest circumference. An X-ray picture revealed the bony structure of a well-developed fœtus.

Study of the specimen after it had been opened and hardened in formalin solution gives the following findings. The gestation sac is, in part, membranous and in part occupied by a thick, friable, spongy mass, evidently placental tissue. The sac varies in thickness from 0.1 cm. in the thinnest membranous portion to 4 cm. in the thickest part. The fœtus measures 40 cm. in length. It is a well-formed female covered with vernix caseosa and in no ways differs from the usual normal fœtus. The cord, which is 55 cm. long, is not attached immediately to the placental area, but is inserted into the membranous portion of the sac at a distance of about 3 cm. from the placental margin. From the insertion of the cord a number of large, thin-walled, tortuous vessels radiate in all directions and ultimately find their way to the placental area. Some of the vessels leading from the cord run on the inner aspect of the sac and some on the outer. One of the external vessels presents a small rupture of its thinned-out wall.

Microscopic examination of a section through the thin membranous portion of the gestation sac shows stratified fibrous structure rather well vascularized and lined internally by the amnion. There is no apparent muscular tissue in this portion of the sac.

Microscopical examination of a section through the thicker area shows typical placental tissue of the later months of pregnancy, which is implanted upon a thick lamellar structure composed chiefly of concentric layers of fibrous tissue in which can be seen what are apparently bundles of smooth muscle. The attachment of the placenta to this fibromuscular wall is not an immediate

one, but is obtained through the medium of a layer of large vesicular cells which bear considerable resemblance to decidual cells. This layer varies in thickness in different portions and in some parts spreads out into thin strands which are themselves separated by fibrous bands.

Dr. Whiting remarked that this case was of more or less interest on account of the length of gestation; and on account of the termination, rupture of the vessel on the outer aspect of the wall of the gestation sac without any rupture of the sac wall. The absence of symptoms of tubal pregnancy might be noted, as well as the perfect freedom of the tumor within the abdominal cavity, there being no restriction other than its attachment to the broad ligament and the cornua of the uterus.

Although Tait, in his memorable articles on the subject of tubal pregnancy, claimed that primary rupture of the sac of a tubal gestation occurred at or before the fourteenth week, numerous cases greatly exceeding this period, without rupture, have been recorded. The average length of tubal gestation, without rupture or the expulsion of the embryo through the fimbriated extremity, however, is much less than that recorded in this case. Thus Webster quotes Henning as having reported 95 cases of tubal pregnancy in which rupture occurred in 80 per cent. before the sixth month. In this series of cases, 1 ruptured in the sixth month; 1 in the seventh; 6 in the eighth; 1 in the ninth; 9 in the tenth, and 1 beyond the tenth month. In Von Schrenk's 141 collected cases, in Schauta's 87 cases, and in Mackenrodt's 38 cases, rupture took place in every instance before the expiration of the fourth month (quoted by Webster).

At the German Hospital, during the last ten years, there have been 128 cases of tubal pregnancy. Operations in these cases were performed by Dr. J. B. Deaver, to whom he was indebted for the privilege of citing them, by Dr. G. G. Ross or himself. In 99 of these patients, rupture through the wall of the tube had taken place; in 10 the products of gestation, in whole or in part, had been expelled through the fimbriated extremity; and in 5 there had been bleeding from the fimbriated extremity at or before the time of operation. Fourteen cases were operated upon before rupture or bleeding had taken place.

Among the cases that ruptured, aborted, or bled from the fimbriated extremity, the catastrophe occurred in 3 during the first month; in 57 during the second month; in 30 during the third

month; in 13 during the fourth month; and in 2 during the fifth month. In 9 cases the period of gestation was not stated.

In a very limited search through the literature of tubal pregnancy, he was unable to find any reference to a termination similar to that recorded in this case. In all of the cases noted, there was rupture of the sac wall; expulsion through the fimbriated extremity; or free bleeding from the fimbriated extremity without expulsion of the gestation products. In this case there was a rupture of the wall of one of the ribbon-like vessels without any discoverable rupture of the sac. This rupture was possibly caused by traumatism during the violent vomiting and retching, although the vomiting may have been due to the ruptured vessel and not to the sandwich, to which the patient attributed it. If caused by the marked activity of the fœtus on the day of the rupture, it is probable that some signs of internal violence would have remained or that the sac itself would have been ruptured. Possibly the vessel had reached the extreme limit of stretching and could not be thinned out any more.

RECURRENT STONES IN THE URINARY BLADDER.

Dr. Harry S. Carmany, in presenting this case, said that he had reported it before to the Academy in 1911 as one of a rather large stone removed by spinal anæsthesia. At that time cystoscopy was ineffectual on account of size of stone, although sounding and X-ray discovered it. He was admitted to St. Timothy's Hospital October 11, 1911. He was fifty-eight years old. On admission complained of frequent urination and a sense of burning in perineum. Sound revealed stone, X-ray confirmed it. Removal under spinal anæsthesia; was in hospital 49 days, when he was discharged cured. He remained well until June, 1913, when he again began to have frequent urination and burning in perineum; July 10, 1913, he was again admitted to the hospital with a distended bladder. His condition was such that little time was consumed trying to pass instrument, and suprapubic drainage was immediately decided on. He was given chloroform, as his cough was still present which had determined the use of spinal anæsthesia at the first operation. On opening his bladder, a calculus was forced out and on examination another one was found loose in bladder and yet another impacted in the posterior urethra.

Dr. Alfred C. Wood said, in regard to the re-formation of

stones, or stones thought to have been overlooked at the time of operation, if a patient has some obstruction to the emptying of the bladder, either prostatic or urethral, and particularly if he has infection of the urine with ammoniacal decomposition, stones may form in a comparatively short time. Also in a certain number of cases there may be stone lodged in the ureter which later coming down forms a nucleus for a larger stone. He recalled one case in which during a suprapubic lithotomy, after removing a great many stones, four ounces in all, one was found projecting from the ureteral orifice. This was removed, when another was felt and removed, and so on until five had been delivered from the lower end of the ureter. If these had not been discovered they might later have appeared in the bladder and given the impression that they had been left from the previous operation.

Dr. John Speese said that about three years ago he operated upon a boy two years of age, and removed three stones from the bladder by the suprapubic method. The boy returned to the Children's Hospital several months ago with renewed symptoms of vesical calculus, and another stone was removed by Dr. Wharton. The calculi removed at the first operation were phosphatic, octagonal in shape, smooth, and each was about the size of a small hickory nut. The stone removed at the second operation was about the size of an almond, mulberry in appearance and was composed of urates. After complete recovery symptoms of a stone in the kidney developed, and an X-ray corroborated the diagnosis.

Such a case demonstrates the possible recurrence of vesical calculi at an early age, although the subsequent history of a kidney stone points to this organ as the point of formation of the vesical calculi.

Dr. Addinell Hewson, in connection with the stones not being found, said that some years ago he found in a man whose history he obtained subsequently, eighty years of age, who came from an almshouse in the interior of the State, a completely encysted mulberry calculus about the size of an ordinary thimble, completely walled off from the bladder. It was just behind the symphysis pubis. The man had complained of no symptoms whatever of stone.

SARCOMA OF THE SMALL INTESTINE.

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The clinical and pathological aspects of sarcoma of the small intestine have been thoroughly reviewed in the comprehensive papers of Baltzer, Rheinwald, Lecene and Libman. While little can be added to their conclusions, the writer desires to report two new cases and to summarize the results of operation in the large number of cases which are now on record.

A statistical review of sarcoma of the intestine proves the rarity of the affection, as Baltzer in 1894 was able to collect 14 cases, Libman 59 cases in 1900, and Lecene 89 cases in 1904. The autopsy records in various large hospitals also confirm the view that sarcoma is infrequent in the intestinal tract, especially when compared with carcinoma. Nothnagel found 243 instances of carcinoma of the intestine in 2124 autopsies on cancer cases, while of 243 sarcomata but three were in the bowel. Smoler in 13,036 autopsies found 13 cases of primary sarcoma of the small intestine. Sarcomata of the large intestine, excluding the rectum, are much less common. Of Krueger's cases, 16 occurred in the small intestine, 6 in the large intestine and 16 in the rectum. Jopson and White, in 1901, found 22 cases of the large intestine, whereas Libman's paper appearing a year earlier contained 59 cases of sarcoma of the small intestine.

Sarcoma of the small intestine does not appear to affect any particular age, although Baltzer found that the majority of his cases occurred in the fourth decade. The 75 cases in which the age is mentioned may be divided as follows: 1–10, nine; 10–20, ten; 20–30, seventeen; 30–40, eighteen; 40–50, fourteen; 50–60, five; 60–70, two.

The rather large number of cases occurring at an early

age is a fact of much interest. The tumor in Stern's case was present at birth and caused intestinal obstruction from which the child died. In addition to this instance, sarcoma of the intestine has been observed in children of five and six years of age for which successful operations have been performed (Power, Barling, Zwalenburg).

Any portion of the small intestine may be the seat of a primary sarcoma. The following is an analysis of 53 cases in which the part involved is mentioned. As many of the case reports merely state that resection of the small intestine was performed, they could not be included. Duodenum and jejunum, 3; jejunum, 12; jejunum and ileum, 2; ileum, 32; entire intestinal tract, 4.

All writers on the subject mention the predisposition of the male sex in intestinal sarcoma. Adding the cases which I have collected to Lecene's we find of 101 instances, 67 occurred in males and 34 in females, or practically twice as many in the male sex.

As lymphosarcoma constitutes one of the chief types of intestinal sarcoma and as such growths tend to spread early to the neighboring lymphatic nodes, the mesentery of that portion of a bowel in which the sarcoma arises is involved frequently. In 45 autopsies 34 (75 per cent.) instances of mesenteric involvement are recorded by Lecene, a fact demonstrating the importance of thorough removal of the mesentery of the affected bowel. On the other hand metastasis to the superficial lymph-nodes or those in the retroperitoneum or mediastinum is rare.

Involvement of practically all the abdominal viscera has been noted in advanced cases, although the liver and kidney are especially liable to metastatic deposits. Direct extension to the peritoneum of adjacent viscera is quite common, and at the time of operation several loops of gut may require resection. Involvement of the bladder is met with frequently because the tumor in many cases occupies a pelvic position.

The histological variety of sarcoma is of great interest in connection with the question of metastasis. The majority of recurrences or metastases have arisen in lymphosarcoma or in

the round-cell variety. The spindle-cell sarcoma, on the other hand, has a pronounced tendency to remain localized. This fact is explained partly by reason of the stenotic action such tumors exert on the intestine, in consequence of which the indications for early operation arise before marked extension can occur.

The association of single traumatic insults has long been held important in the development of sarcomata in general. The numerous instances recorded by Coley, Lowenstein and others support this view. It is not surprising, therefore, that such a factor is mentioned in some of the reported cases and is of particular interest, as the disease occurs much oftener in the working class. Zwalenburg records an abdominal injury in a boy aged five; six weeks later a tumor one inch in diameter was noted at the site of injury. Nothnagel observed a case of lymphosarcoma developing on the base of an old tuberculous ulcer. The association of tuberculosis and lymphosarcoma elsewhere has been observed and is regarded as an accidental association. Three cases of sarcoma have been reported to have occurred in the ileum years after severe attacks of typhoid fever. Firth noted an instance developing five months after an operation for strangulated hernia. Syphilis has also been present in several cases.

From these factors of more or less etiological importance, we are unable to draw any conclusions which might throw light upon the cause of intestinal sarcoma.

Kasemeyer has investigated very thoroughly the subject of intussusception caused by tumors, and has collected 284 cases, of which 85, or 30 per cent., were caused by malignant formations. Of these 85 cases, 57 were carcinoma and 26 were sarcoma. The symptoms of intussusception as seen in children, the severe abdominal pain, vomiting, bloody and mucous stools, are seldom present in intussusception secondary to tumor formation. In such cases a chronic course is pursued and the symptoms extend over months even with an intussusception present, as is demonstrated by the dense adhesions about the bowel or by extension of the invaginated tumor to the intestinal wall with which it comes in contact. The in-

frequency of complete obstruction following tumor intussusception is explained by the fact that the infiltrated intestinal wall undergoes dilatation.

Tenesmus may be the chief symptom complained of, but is as inconstant as is meteorismus and abdominal tenderness. The presence of a sausage shaped tumor, the situation of which varies, along with other symptoms of chronic intestinal obstruction, has been regarded as distinctive of tumor invagination by several observers, and the diagnosis correctly made (Ewald, Kasemeyer).

Many varieties of sarcomata have been observed in the intestine; the 99 cases in which the type is mentioned are divided as follows: Lymphosarcoma, 34; round-cell sarcoma, 43; spindle-cell sarcoma, 13; fibrosarcoma, 3; mixed-cell sarcoma, 1; myxosarcoma, 2; myosarcoma, 2; melanotic sarcoma, 1.

The lympho- and round-cell sarcomata greatly predominate. Many cases diagnosed as round-cell sarcoma probably belong to the lymphosarcoma group, but the histologic descriptions are too incomplete and indefinite in many cases to make the classification correct.

The tumors in the majority of cases originate in the submucous tissues (lymphosarcoma) or in the connective tissue of the muscularis or perivascular region, and in some instances reach a considerable size without producing any ulceration of the mucous membrane. They may extend parallel to the long axis of the bowel, producing a gradual infiltration of all the tissues but not causing stenosis. The bowel above the area of infiltration frequently undergoes dilatation and resembles an aneurism; the lumen of the intestine, in such cases, is filled with necrotic tumor tissue, pus and fecal material. Dilatation of the intestine is seen in the round-cell and lymphosarcomata, whereas stenosis and obstruction result from the fibrosarcomata. In exceptional cases the tumor extends through all the coats of the gut, gradually involving neighboring coils and forming a large adherent mass. The tumor may be single or multiple; in the latter event the growths appear as plaques or small nodules under the mucosa. The single

tumors, especially if pedunculated, are singularly prone to produce intussusception, although this complication has developed in the infiltrative types of tumor.

Marked variations exist in the size of the tumors, although as a rule the growth has reached considerable proportions before the diagnosis has been made or the operation performed. The shape is spindle, the contour irregular and the consistency firm in most cases.

Although partial occlusion of the bowel is present in about one-half of the cases complete stenosis practically never develops from the mere presence of the sarcoma. Even in large tumors encroaching upon the intestinal lumen, a narrow passageway can be demonstrated, thus explaining the chronic intermittent symptoms of intestinal obstruction. When complete occlusion occurs and is followed by the symptom of ileus, the condition is caused by adhesions or by an intussusception.

Sarcoma of the small intestine manifests itself in the beginning by symptoms of an indefinite nature. In the majority of patients generalized abdominal pain is first noted; this is followed by loss of appetite, nausea, vomiting, the bowels are irregular, diarrhœa alternates with constipation, and distention of the abdomen soon follows. The patients are very thin, pale and weak, when first seen. Moderate elevation of temperature and slight leucocytosis may be present. Unless the acute obstruction is due to kinking of the intestine or to an intussusception, complete constipation is unusual, although repeated attacks of obstinate constipation may be complained of. Baltzer and Nothnagel both asserted that apart from complications, sarcoma of the intestine does not produce symptoms of stenosis. This view has been disproved by subsequent articles, in which it has been shown that at least 55 per cent. of the cases do have symptoms indicative of some degree of intestinal obstruction, but the course is not similar to the stenosis caused by cancer of the bowel. When carcinoma produces an obstructive lesion, the course is generally a protracted one and the patient's loss of strength and weight is slow and gradual. Sarcoma, on the other hand, causes rapid loss of weight,

the disease rarely lasting over a year and the average duration, according to Rheinwald, being four to five months.

A careful study of the histories of many cases shows that attacks of constipation and diarrhœa are common, although these symptoms are wanting in a small proportion of the cases. It is also worthy of note that in many instances vague intestinal disturbances are the earliest symptoms noted, and that operation performed a few weeks or months later will often reveal a larger or even inoperable sarcoma.

Blood in the stools has been present in a small proportion of the cases, and is sometimes one of the earliest symptoms mentioned.

In a few instances the patients have noted the presence of a tumor. This on examination varies considerably in size, the surface is smooth and nodular, and unless seen quite late, the growth is freely movable. Its consistency is as a rule dense and hard. In late cases metastatic nodules are palpable and the primary growth demonstrated with difficulty.

As the result of pressure of the tumor on the intestine, distention may result, and pressure on the vessels may produce ascites, or œdema of the legs, distention of the veins of the abdominal or thoracic walls, jaundice, dysuria or diminution in the amount of urine (Libman). Examination of the blood shows merely a secondary anæmia.

Libman has classified the varieties of the disease as follows: (1) Latent cases, the disease being first discovered at autopsy. (2) Cases with the clinical picture described by Baltzer, either the general symptoms, the distention of the abdomen, or the tumor being first noted. (3) Cases in which the first symptoms are due to an intussusception or other variety of intestinal obstruction or to perforation. (4) Cases resembling tuberculous peritonitis. (5) Cases in which jaundice is the first symptom. (6) Cases resembling ovarian cysts. (7) Cases bearing a close resemblance to appendicitis, an observation noted first by Libman and described in several reports since that time.

An early diagnosis in these cases seems impossible because the symptoms are so mild and transitory in the beginning.

When, however, a tumor is discovered, freely movable, producing pressure symptoms of a mild type, with the absence of severe obstruction symptoms, sarcoma of the small intestine should be suspected.

The treatment of intestinal sarcoma is of course surgical, although in inoperable lymphosarcomata benefit has been followed by the administration of arsenic. Libman recommended its use even in cases in which successful resection of the intestine has been performed.

For a long time sarcoma of the intestine was regarded as almost invariably fatal. This view is not sustained by an analysis of the cases reported in the past decade, in a large number of which many years have elapsed without recurrence since the time of operation. The vague nature of the symptoms delays operation, although a palpable tumor is almost invariably present at the time of operation and a history of a chronic intestinal disturbance can be obtained in the majority of cases.

The number of resections of the small intestine for sarcoma is 75; of these 15 are collected by Zwalenburg, 37 by Moynihan, 6 by Lecene, 17 by Speese. There were 55 recoveries (74 per cent.), and 19 deaths following operation. Nine instances of recurrence are noted, the periods varying from three months, 5 months (2), 12 months (2), 15 months. The cases in which recurrence arose in 7 instances were diagnosed as lymphosarcoma or round-cell sarcoma, thus emphasizing the malignant nature of this variety; one case of myxosarcoma recurred.

When the infiltration of the bowel is too extensive for removal or metastasis has occurred, the abdomen should be closed without further exploration. If stenosis is present some surgeons advise an artificial anus to relieve the immediate and urgent symptoms.

The large number of intussusceptions noted in the series is a matter of considerable interest and importance. In 14 of the 74 resections, this complication was encountered. Ten of these 14 cases recovered, 1 died immediately after operation, and 3 from recurrence. The type of tumor has no influence

upon the development of an intussusception, for the complication has occurred in the round-cell, the lymphosarcoma and other forms. A pedunculated tumor may predispose to invagination, but it also follows cases in which the intestinal wall is extensively infiltrated by the tumor.

The amount of small intestine resected in the majority of cases is from 10 to 40 cm. Barclay removed 190 cm., and Storp 510 cm. of the bowel. In the former case the patient suffered from frequent and liquid stools, and in the latter no metabolic or other disturbances were noted.

The effect of the removal of large amounts of small intestine has been investigated experimentally by Flint, whose conclusions are of great importance in view of the radical measures which may have to be undertaken in some of the cases. It was found that in dogs as much as 50 per cent. of the total intestine may be removed without fatal results, and the animals may gradually return to a condition of practically normal weight and metabolism when maintained on a favorable diet under good conditions. Resections of 75 per cent. or more of small intestine may be survived, but such animals do not show a return to normal weight with the establishment of a good compensatory process.

Animals at first suffer from a severe diarrhœa, ravenous thirst and appetite, and loss of weight, from which they gradually recover until conditions may return to those of a normal animal. They remain extremely sensitive to unfavorable conditions of diet and living.

The compensatory process consists in a hypertrophy and hyperplasia of the remaining portion of the small intestine. There is no regeneration of villi or crypts.

Human cases behave in general like animals and show similar metabolic disturbances. There are over 58 cases in the literature in which over 200 cm. of small gut have been resected. The mortality is 16 per cent., which is lower than it should be, as only the successful cases have probably been reported. Metabolic disturbances in human beings bear no definite relationship to the amount of small intestine resected.

Resection of over 400 cm. of intestine has been followed by recovery, while death from inanition has resulted from resection of 284, 289, 300, 380 cm. respectively.

Profound digestive disturbances have resulted from removal of 192 and 204 cm. of ileum.

Progress in human cases should be guarded. Apparently successful resection may, for lack of suitable compensation, succumb ultimately to a slow process of inanition. Experiments and series of human cases emphasize the fact that neither the stomach nor the colon is able to compensate for the loss of large portions of small gut.

The writer desires to express his thanks for permission to report the following cases, operated upon by Dr. John B. Deaver at the University Hospital.

Male, aged fifty, has been suffering with hemorrhoids for several years and for the past several weeks has complained of constipation, distention of the abdomen, severe cramps and vomiting. The constipation was relieved by enemas and laxatives, the resulting movements were as black as ink, although free blood was not noticed. He has had successive attacks of pain, tenderness and obstinate constipation. The mass was not discovered until the time of examination, seven weeks after his symptoms began. The examination disclosed a round mass in the right lower quadrant of the abdomen. The tumor is tender, regular in outline, and is movable.

Blood examination, red blood cells 4,980,000, polynuclears 70, white blood cells 9,800, lymphocytes 20, hæmoglobin 100, monoleucocytes 0, transitionals 1, eosin 0.

Examination of the fæces for occult blood was negative.

Operation.—A large mass about the size of an orange was found in the ileum about 3 feet from the ileocæcal junction. The ileum was resected with its corresponding portion of mesentery, and end-to-end anastomosis was performed. Five days after the operation the patient developed a fecal fistula; this was followed by peritonitis, from which he succumbed eleven days after the operation.

Pathological Examination.—The specimen consists of 57 cm. of ileum. The intestine at one area contains a globular mass 8 cm. in diameter, the wall of the intestine is enormously thickened, measuring 3 cm. The section through this thickened portion shows that the intestinal mucosa is

greatly ulcerated and that the lumen of the bowel is represented merely by an irregular area of ulceration through the centre of the tumor mass. At one point the lumen is almost completely occluded by the tumor tissue (Fig. 1). The tumor mass, as represented by the greatly infiltrated wall of the intestine, is composed of firm whitish tissue which is completely surrounded by the serous coat of the intestine. In the mesentery several enlarged nodes having the same characteristics as the primary tumor are found.

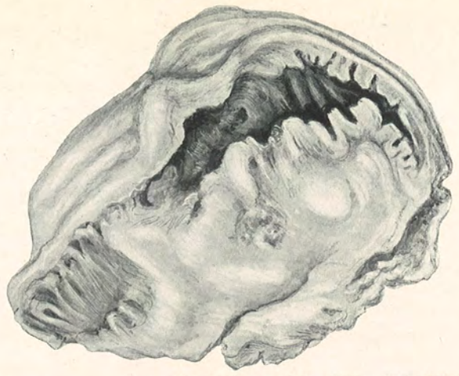
Microscopic examination shows a very cellular formation composed of small, round, deeply staining cells, having a fairly uniform appearance. The stroma is composed of thin fibrils which ramify between the tumor cells, which extend to the mucosa and infiltrate and destroy the intestinal glands. The structure of the muscular coats of the intestine is completely obliterated by the cellular infiltration. The tumor contains very minute areas of necrosis and is fairly well supplied with new blood-vessels. The lymph-nodes removed from the mesentery show a similar involvement.

Diagnosis.—Lymphosarcoma.

Female, aged fifty-seven, was admitted to the University Hospital complaining of pain in the abdomen. Her past medical history is unimportant. One sister died of cancer of the stomach. Her present illness began one month before her admittance, when she was suddenly seized with agonizing pain in the abdomen. The pain was localized to the region of the umbilicus; the attacks were accompanied by vomiting. The attack lasted twenty-nine hours. The patient recovered and was well for a period of three weeks, when the pain again returned. The pain has been persistent, is constantly localized to the region of the umbilicus; the bowels are regular; there has been some distention of the abdomen. On examination a mass the size of a grape fruit is palpable in the lower and middle portion of the abdomen. The upper limit of the tumor is about one inch below the umbilicus. The mass is smooth, round and slightly movable. Red blood cells 3,710,000, polynuclears 70, white blood cells 20,000, lymphocytes 23, hæmoglobin 60, monoleucocytes, 3, transitionals 4, eosin 0.

Operation.—On opening the abdomen a mass was found in the mesentery, in the midline; the surrounding coils of intestine were attached to it by adhesions. The coil of ileum which surrounded the tumor and the mesentery were excised and a lateral anastomosis formed. A supravaginal hysterectomy was performed for a large subserous fibroid tumor. Recovery; no evidence of recurrence three months after operation.

FIG. 1.



Lymphosarcoma of intestine showing partial occlusion of the lumen.

FIG. 2.

Myxosarcoma of mesentery.

Pathological Examination.—The specimen consists of a tumor which is surrounded by a loop of small intestine, which measures 80 cm. in length. The tumor, which measures 8 cm. in diameter, is situated near the base of the mesentery and is attached to the intestine for a distance of a few centimetres only. The wall of the intestine appears normal and is not compressed by the tumor mass. On cross section the tumor is soft in consistency, the cut surface for the most part is white and contains numerous reddish areas and small points of necrosis.

On microscopic examination the growth for the most part is composed of tissue containing large stellate cells. The connective tissue in these areas is of very loose texture, and contains within its meshes a homogeneous substance taking a faint blue stain. Large numbers of blood-vessels with thin walls are present. A considerable amount of free blood is found in the fibrous tissue. In addition to the stellate cells mentioned, there are many areas in which large numbers of cells are closely packed together, the cells being spindle in type, some are large, some small and many being arranged around the blood-vessels. Minute areas of necrosis are encountered, and in these situations leucocytes are found between the tumor cells. Many nonstriated muscle fibres are seen in the more superficial portions of the tumor.

Diagnosis.—Myxosarcoma of mesentery.

REFERENCES.

Barling: Annals of Surgery, 1907, xlv, 242.
Zwalenburg: J. A. M. A., 1901, xxxv, 617.
Rheinwald: Brun's Beiträge, 1901, xxx, 702.
Munk: Brun's Beiträge, 1908, lx, 197.
Eccles and Laidlow: St. Bartholomew Hospital Reports, 1911, xlvii, 97.
Erdmann: Annals of Surgery, 1910, li, 122.
Scudder: S. G. O., 1911 xii, 72.
Miller: Trans. Southern Surg. Asso., 1912, xxv, 133.
Stone: Trans. Southern Surg. Asso., 1912, xxv, 141.
Firth: Lancet, 1908, March 21, 1851.
Libman: Am. Jour. Med. Sc., 1905, cxxix, 813.
Libman: Am. Jour. Med. Sc., 1900, cxx, 309.
Gartner: Deut. Zeit. Chir., 1912, cxx, 182.
Stern: Berliner klin. Woch., 1909, xlvi, 1689.
Storp: Deut. Zeit. Chir., 1907, lxxxvii, 313.
Courvoisier: Arch. f. klin. Chir., 1902, xlvi, 448.
Baltzer: Arch. f. klin. Chir., 1892, xliv, 717.
Anderson: British Med. Jour., October 5, 1907, 886.
Steinthal: Münch. med. Woch., 1904, li, 751.
Bjor kenheim: Cent. f. Gyn., 1912, xxxvi, 1329.
McGlinn: N. Y. Med. Jour., 1908, lxxxviii, 1127.
Flint: Bull. Johns Hopkins Hospital, 1912, xxiii, 127.
Lecene: Theses de Paris, 1903–4, xxvii, No. 196.
Kasemeyer: Deut. Zeit. Chir., 1912, cxviii, 205.
Jopson and White: Am. Jour. Med. Sc., December, 1901.

Sawyer: Iowa Med. Jour., 1912, ii, 153.
Fletcher: Practitioner, 1909, lxxxiii, 374.
Power: Clin. Jour., 1912, xv, 193.
Patek: Zeit. f. Gyn., 1913, xxxvii, 414.

Dr. John H. Jopson remarked that in 1901, Dr. C. Y. White and he reported a case of sarcoma of the large intestine in a child of four years. They collected, as Dr. Speese had mentioned, 22 cases of sarcoma of the large intestine above the rectum, all that they could find in the literature at that time, and they excluded all cases in which there was not a reasonable certainty that the process was primary in the large bowel. Shortly before this Libman had collected 59 cases of sarcoma of the small intestine, and the difference in the number of cases in his series and in theirs represents fairly accurately the comparative percentage of frequency of sarcoma in these two portions of the intestine.

In the rectum sarcoma is more frequently met with than in either the large bowel or the small intestine, but its symptoms do not differ materially from carcinoma of the rectum; whereas, in the remainder of the large intestine, namely, the cæcum and colon, the symptoms are so strikingly different from carcinoma that the difference has been emphasized by all observers. This is due especially to the absence of obstruction in cases of sarcoma, an observation that is also true of sarcomata of the small bowel.

Dilatation of the affected region, either as a fusiform or sacculated dilatation, is the rule, although in some cases the bowel is converted by infiltration into a thick-walled tube. This dilatation has been explained by the early infiltration and paralysis of the muscular fibres. In only one of the 22 cases which they studied was complete obstruction present. In this case the tumor was of the spindle-cell type and situated in the descending colon, causing almost complete stenosis with impaction of the opening by a small fecal mass. In one other case of a round-cell sarcoma of the sigmoid flexure incomplete obstruction was present.

The lymph follicles in the mucosa or submucosa seemed to be the usual starting point in these cases, and from this region the tumor involved the other coats; the muscular offering the greatest, and the subserous coat, the least resistance. The serosa itself was rarely perforated. Dr. Speese mentioned the possibility of sarcoma developing in the subserous coat.

Their cases were almost equally divided as to sex. They ranged in age from 2 to 60. The first decade contained the greatest

number, and the fourth decade the next greatest. There were only three cases over forty years of age. The duration in cases not operated upon varied widely; probably four to six months was the average after the tumor was detected. The mortality in cases operated upon has shown a great improvement since they collected their cases. At that time the mortality was 50 per cent. Of the cases recovering, one died of a quick recurrence. The other four were living at the time they were reported.

With our present familiarity with operative technic and the early performance of operation in abdominal tumors the mortality is no doubt at the present time very much below this figure.

Dr. John H. Gibbon said that he had never seen a sarcoma of the small intestine but was interested especially in the question of resection in this condition. As surgeons realize the importance of the small intestine as a digestive organ their respect for the stomach decreases. One may get along very well without a stomach, but it is difficult without the first portion of the small intestine. One may take out only a small amount, two or three feet, of small intestine, and the patient will suffer greatly from inability to digest his food. He had seen this even where he had only taken out 18 inches two or three feet away from the beginning of the jejunum. The diarrhœa will keep up for months and the patient will go down to a shadow. Most of his cases had been in tuberculous individuals. Two years ago in a case with an enormous lipoma producing intestinal obstruction he did a resection in order to remove the growth which at first he thought to be an inoperable retroperitoneal sarcoma; in this case it was necessary to resect a large amount of small intestine in order to remove the tumor, and he found himself within three inches of the jejunum, with just enough bowel to make an anastomosis, and he had removed 9½ feet of small intestine. This man for a short time had little disturbance, but for 18 months he was very sick; had diarrhœa, could not digest his food, everything gave him pain, he passed his food undigested, lost weight, and only in the last six months has the remaining portion of his intestine taken on the function of the resected portion, so that he is now getting better.

DEPOSIT OF METALLIC SILVER IN BODY TISSUES.

Dr. Addinell Hewson gave a preliminary notice of the fact that he had been able to deposit metallic silver in the glomerule of the kidney in cadavers. The process by which this was attained

was by injecting into the aorta a 2 per cent. solution of nitrate of silver and a 5 per cent. solution of formaldehyde in distilled water. Immediately following this mixture, a 2 per cent. solution of ammonia in distilled water was injected and the deposit of silver could be seen increasing in the papillary layer of the skin, giving the subject a mottled appearance.

Dr. Hewson reported that at a subsequent meeting he would show specimens of this work with the various tissues, but desired to give formal notice of the fact that he had succeeded in making a deposit of metallic silver in the tissues.

MEETING HELD ON FEBRUARY 2, IN CONJUNCTION WITH THE GENITO-URINARY SOCIETY

DR. JOHN H. GIBBON, President, in the Chair

OBSERVATIONS ON THE PATHOLOGY, DIAGNOSIS AND TREATMENT OF SEMINAL VESICULITIS

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THE motives responsible for the presentation of this contribution are two-fold. First, we desire to impress, as forcibly as may be, the medical profession at large with a fact—our solemn conviction—namely, that two small organs, the seminal vesicles, too often disregarded and neglected, if not forgotten, have not received the consideration which is their due as foci of infection, and in the near future will be their demand especially at the hands of neurologists, orthopædists and internists. We refer to a vast array of conditions with a symptom-complex too little understood, as acute and chronic synovitis and arthritis, of an infectious or toxic nature, so-called articular and even muscular rheumatism, rheumatoid arthritis, arthritis deformans, gout, hypertrophic arthritis, chronic bladder disturbances, recurrent epididymitis, impotency, renal and cardiac complications, digestive disturbances and an ensemble of mental and nervous manifestations almost incredible of belief. Obviously, it is not inferred that in the above-mentioned diseases, the vesiculæ seminales are always concerned, but we believe that the medical profession in general would be amazed if not embarrassed to learn how frequently in certain infective, cryptogenic, nervous and arthritic conditions, the depot of infection will be found to be a chronic seminal vesiculitis. Fuller[1] states that "tuberculous joint, arthritis deformans, gout, chronic inflammatory rheumatism, progressive mus-

[1] Fuller: "Seminal vesiculotomy," *Jour. A. M. A.*, November 30, 1912, p. 1961.

cular atrophy and myelitis of some form are among the diagnoses previously made in cases cured through the performance of seminal vesiculotomy. Of eighty-nine rheumatic patients there was not one who was not relieved in a most radical manner and who was not satisfied with the operative result." Second, we wish to make an announcement of work undertaken in a comparative study of various methods of treatment for this common disease, also at this time to submit a number of collargol radiograms illustrative of the normal and diseased seminal vesicle in a study of the living pathology of these organs.

It is remarkably strange, but nevertheless true, that with two structures as intimately associated as are the prostate and seminal vesicles, that the former should have been so thoroughly studied years ago, while the pathology and diseases of the latter, in text-books universally, have been alluded to casually or definitely neglected. The profession owes a debt of gratitude to Fuller[2] and Lloyd, pioneers in this line of work, for their untiring efforts in directing attention to the importance, constitutionally, of seminal vesiculitis and for suggestions as to treatment.

It must be apparent to all that by virtue of the relatively larger lumina of the ejaculatory ducts as compared with the prostatic ducts, that infection in the posterior urethra can and does reach the seminal vesicles more readily than the prostate. Indeed, it has been our experience that over 90 per cent. of gonorrhœal patients exhibit posterior urethritis and that 90 per cent. of posterior urethritides are complicated by prostatites. Thus the percentage of seminal vesiculitis in the male population is very high.

For a thorough comprehension of the importance and magnitude of this disease in its correlation with various other systemic disorders, certain facts relative to the anatomy, bacteriology and histo-pathology of these organs must be understood. In 1911 Picker,[3] before the III Congress of German Urologic Society, presented a classic study, in which he examined about 150 seminal vesicles, dissecting out the tube systems after injecting the vasa deferentia with bismuth paste. From material comprising 56 normal and 16 pathological specimens, he makes the following anatomical classification: (1) Simple straight tubes; (2) thick twisted tubes with or without diverticula; (3) thin twisted tubes with or without diverticula; (4) main tube straight or twisted with

[2] Fuller: The *Jour. A. M. A.*, May 4, 1901, p. 1228; *Med. Rec.*, New York, October 30, 1909; *Jour. A. M. A.*, November 30, 1912, p. 1959.

[3] Picker: "The Anatomical Configuration of the Human Vesicula Seminalis in Relation to the Clinical Features of Spermacystitis." Paper read before the XIV International Medical Congress, London, 1913.

larger grape-like arranged diverticula; (5) short main tube with large irregular ramified branches; (6) miscellaneous, comprising (*a*) embryological abnormalities and (*b*) pathological conditions. Of the normal specimens about one-third belonged to types (1), (2) and (3) and two-thirds to (4) and (5). The lengths of the various vesicles measured from 6 to 23 cm.; the capacities varied from 3 to 11.5 c.c. Thus it is seen that the seminal vesicles, of all the associated glandular structures of the male urethra, possess the most extensive secretory surface with the worst drainage.

In the majority of the types found, short spontaneous healing is anatomically and mechanically impossible, practically always so without massage, sometimes requiring months, and consequently latent foci of infection result.

Just as a pure gonorrhœal cystitis is a condition that probably never exists, so too are most, if not all, infections of the seminal vesicles and prostate mixed. This supposition is confirmed by bacteriological examination of the inflammatory products obtained after massage of these organs. Among the bacteria harbored in chronic seminal vesiculitis, that have been repeatedly demonstrated, may be named the gonococcus, various strains of streptococci, pneumococci, staphylococci, colon bacilli, corynebacteria and tubercle bacilli. It is highly probable that in many cases diagnosed as "gonorrhœal rheumatism," the gonococcus has ceased to play a rôle and that the offending bacterium can be traced to a mixed infection located in a chronic seminal vesiculitis. The clinician should readily appreciate the significance of such bacterial foci so far as systemic affections are concerned, and in comparison with the tonsil, it would seem to us that the greater evil rests with the seminal vesicle in the light of clinical experience and specific treatment. Yet how many male patients in our hospital wards and private practice, exhibiting certain rheumatic and nervous manifestations, are submitted to any examination per rectum, not to mention a proper investigation of their seminal vesicles?

Again extensive tissue changes supervene in severe grades of infection. In addition to intravesicular inflammation and loculated accumulations of exudate composed of pus, various bacteria, etc., an interstitial spermacystitis occurs in many cases, resulting in thickening of the vesicle wall. Indeed, commonly it is the case that perivesicular infiltrates form about the base of the bladder and prostate and extend through the perirectal tissues, occasionally pointing in the perineum or rupturing into the rectum or bladder.

Convinced, therefore, of the prevalence of this disease and the often

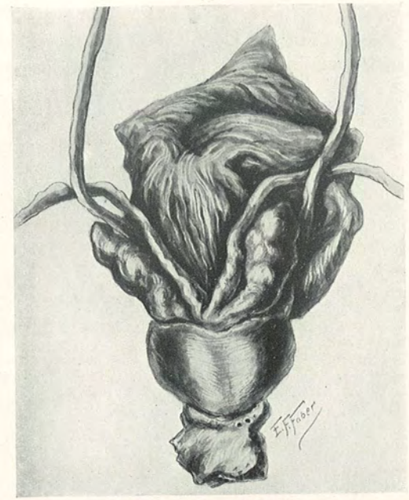
remote effects produced by its existence, necessitating greater consideration on the part of all physicians as to precision of diagnosis and the adoption of the best form of treatment, we have been engaged recently in a partial study of this problem. The treatment of seminal vesiculitis comprises a number of methods. Appropriate, intelligent and efficient *massage* is unquestionably the best procedure primarily in the average case and will suffice to effect cure in the majority. In not a few cases the accessory value of *autogenous bacterins* may be utilized with gratifying success. Occasionally, spontaneous cures, after a long time, will occur. In each patient the proposition should be viewed from the anatomico-pathological stand-point. Thus, the following considerations arise: (1) Is the ejaculatory duct strictured or obstructed? (2) Is the vas deferens strictured? (3) Is the inflammatory collection in the seminal vesicle loculated? Belfield, in the consecutive examination of 25 cadavers, found the ejaculatory ducts strictured on both sides in 1 case and unilaterally in 2 cases. Aschoff found the deferentia strictured bilaterally in 6 and unilaterally in 17 cases, in an examination of 1000 subjects. Assuredly, if the ejaculatory duct is completely stenosed, massage will be futile as a form of treatment. On the other hand, if the vas is occluded near the seminal vesicle, *vasopuncture* or *vasostomy* and direct medication will accomplish nothing. *Seminal vesiculotomy* ardently advocated by Fuller, and performed by him with wonderful success in about 300 cases, has a definite indication in a certain percentage of cases. We prefer, however, the method of Voelcker, permitting as it does a better exposure of the vesicles and allowing freer and more definite incisions for drainage of the infected organs. *Vesiculectomy,* the most radical procedure, should be reserved for the grave, chronic cases, and, if the process is tuberculous, should be chosen in preference to vesiculotomy.

Since, therefore, operation should be considered only after massage has failed or availed naught, and since the particular operative procedure to be adopted depends upon the pathological condition present in the vesicle, ejaculatory duct or vas, it behooves the surgeon to familiarize himself with the morbid process. This knowledge may be acquired through rectal palpation and by needle puncture of the vas in an attempt to inject a normal amount of solution, as boric acid, into the seminal vesicle. In place of boric, collargol in ten per cent. solution, as suggested by Picker [4] and Belfield,[5] may be utilized and has the additional

[4] Picker: *Loc. cit.* (Collargol preparation No. 57).

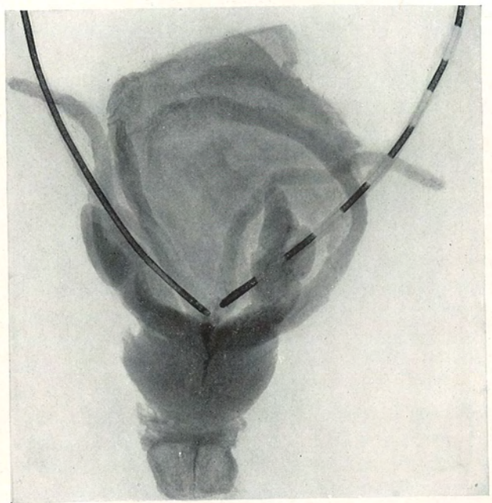
[5] Belfield: *J. A. M. A.*, p., 800, March 15, 1913; p. 1867, November 22, 1913; *Surg., Gyn. and Obst.*, p. 569, May, 1913; November, 1906.

FIG. 1.



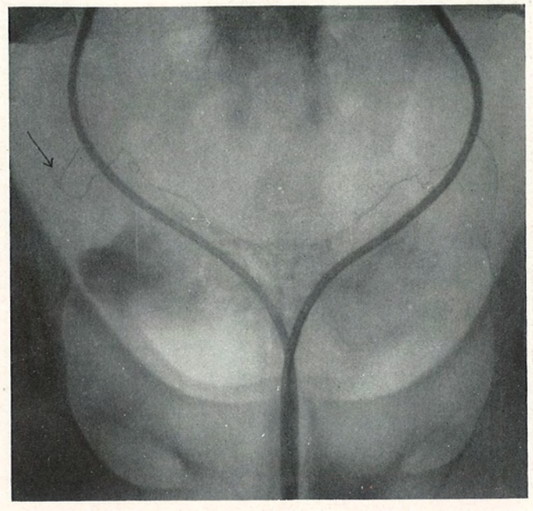
Drawing of dissection by Dr. Addinell Hewson of normal seminal vesicles, showing their relationship to the ampullæ of the vasa deferentia, the ureters, the bladder and the prostate.

FIG. 2.



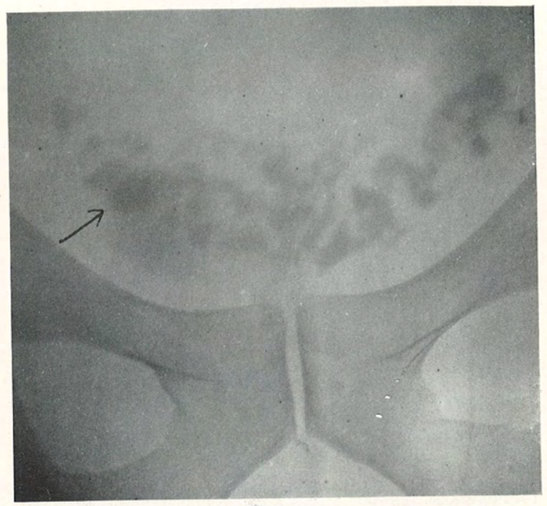
Collargol radiogram of anatomical specimen shown in Fig. 1. The right seminal vesicle has been injected through the vas with three cubic centimetres of collargol; the left vesicle has been slightly injected. Observe the leakage of collargol through the right ejaculatory duct into the urethra. Both ureters have been catheterized with radiographic catheters, defining their relationship to the vesicles and vasa deferentia.

FIG. 3.



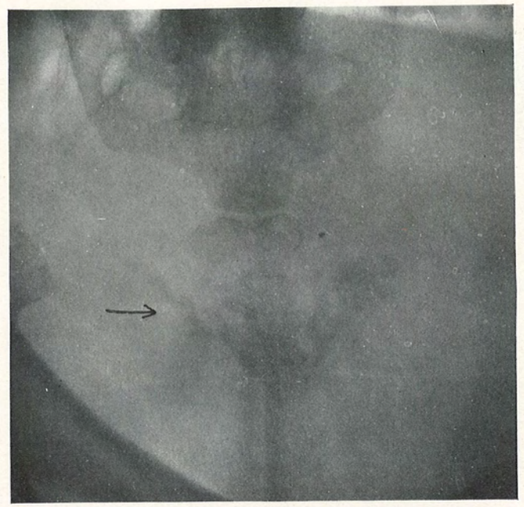
Patient never had venereal disease; seminal vesicles normal; had seminal colliculectomy for fibroma one month prior to collargogram. Note tortuosities of vasa deferentia. Observe radiographic catheters in ureters and relationship of same to vesiculæ seminales.

FIG. 4.



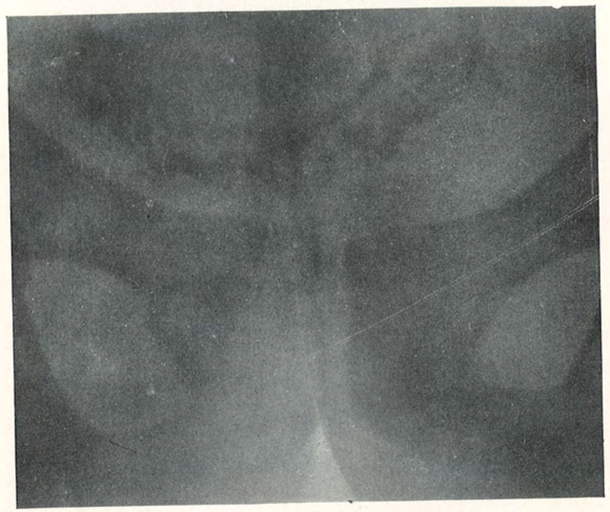
Chronic seminal vesiculitis. Each side injected with fifty minims of collargol. Clinically by palpation there existed a nodule on the right side, evidencing a loculated collection of pus or seminal pyovesiculosis. This is confirmed by the shadow in the skiagram.

FIG. 5.



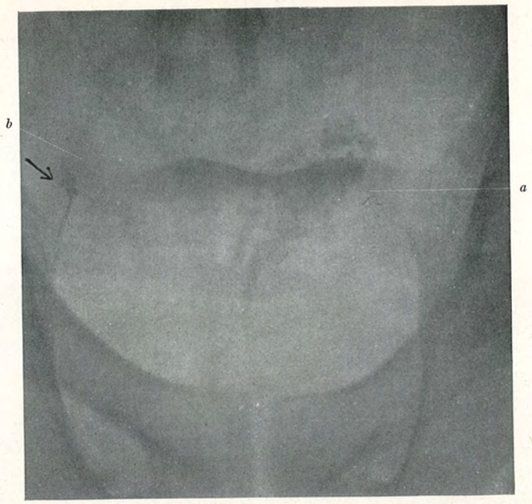
Chronic seminal vesiculitis. Sixty minims of collargol injected in each side. Clinically the right vesicle is nodular on palpation and radiographically seems to demonstrate partial obliteration of its lumen.

FIG. 6.



Chronic spermocystitis. Sixty minims of collargol injected on each side. Clinically cured.

FIG. 7.

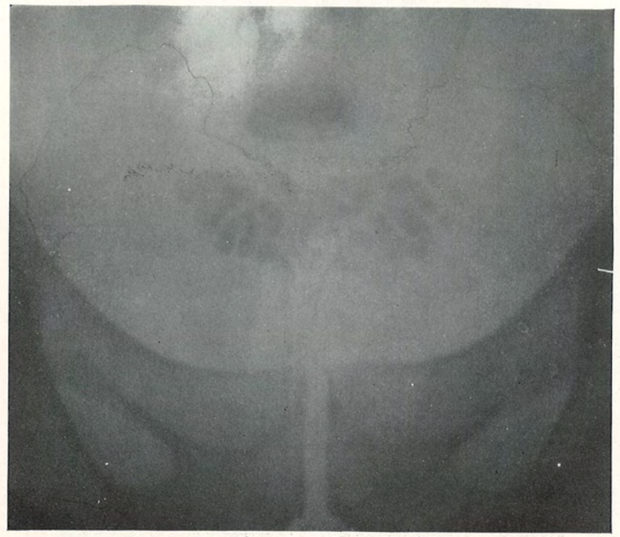


a, chronic seminal vesiculitis (left); *b*, stricture and complete occlusion of right vas deferens. A small shadow shows the extent of collargol injection on the right side; only twenty minims were injected. The left vesicle, injected with sixty minims, was clinically enlarged and tender.

FIG. 8.

Chronic seminal pyovesiculosis. Fifty minims of collargol injected into each side.

FIG. 9.

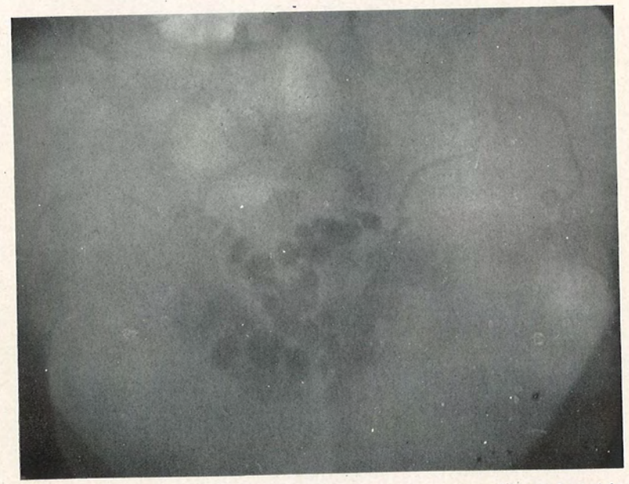


Subacute seminal vesiculitis. Each side injected with 70 minims of collargol. Observe the courses of the vasa deferentia.

FIG. 10.

Chronic seminal vesiculitis (right). Observe normal vesicle and injected vas throughout its course on the left side. Seventy minims of collargol injected on each side.

FIG. 11.



Chronic seminal vesiculitis (bilateral). Eighty minims of collargol injected on right side and seventy on left. Note very large ampullæ of vasa deferentia and courses of the latter on both sides.

advantage of permitting radiographic studies of the living pathology. In addition to its diagnostic value, collargol possesses also a definite therapeutic effect. It has occurred repeatedly during the past few months that after these collargol injections there has followed a reduction to the normal in the number of pus cells expressible from the seminal vesicles; the thought has occurred that this procedure may be the means of aborting an acute seminal vesiculitis. Moreover, in a number of cases this operation has been followed by the disappearance of reflex perineal, pubic, urethral, vesical and neurasthenic pains. Sufficient time has not yet elapsed to judge of the permanency of these results or possible cures. In the near future, a study of the comparative effects, therapeutically, of various other medicaments, as emulsion of the iodide of silver, silver nitrate, protargol, hegonon, etc., will be reported.

The technic of this collargol or other drug injection of the seminal vesicle or operation of *vasopuncture* is very simple. With a good assistant holding and fixing properly the vas in the neck of the scrotum, the duct can be exposed after cutaneous infiltration anæsthesia in a very few minutes. If care is taken to strip it of its most intimate sheath and a proper sized needle is selected for the puncture, little difficulty should be experienced in injecting the medicament, using from four to five cubic centimetres. A Crile clamp is placed on the vas distal to the puncture, while injecting the collargol. A suture of catgut in the fascial sheaths and one in the skin completes the procedure. The patients invariably experience more or less pain in the perineum and not a few develop a chemical funiculitis of two or three days' duration. Indicative of therapeutic effect, the urine appears dark brown or black for a couple of days and shows macroscopically the presence of collargol for about a week; microscopically, brown crystals of collargol, particularly after massage, are seen for a much longer time. There is some evidence to show in a few cases that simple puncture and injection, as described, will render vasostomy, as described by Belfield,[5] unnecessary; moreover, the puncture method or operation of vasotomy may be repeated from time to time if desirable.

We have selected from our series of cases a few collargol radiograms typifying a number of conditions encountered. First, in studying the anatomy and relations of the normal seminal vesicles (Fig. 1), for the preparation and dissection of which we wish to thank Dr. Addinell Hewson, it will be observed in comparing the collargol injected anatomical specimen (Fig. 2) with the clinical cases following, that we have apparently graphic evidence of the presence of a sphincter of the ejaculatory duct, since only in the anatomical specimen is the collargol

visible in the duct. Observance should also be made of the relationship of the ureter to the seminal vesicle, since it will be appreciated how in the case of seminal pyovesiculosis or perivesiculitis, ureteral irritation or even urinary obstruction may supervene.

In summarizing our studies the following conclusions have been deduced:

1. Chronic seminal vesiculitis is a far more prevalent disease than the average physician surmises, and masquerades under a manifold symptomatology finding its expression ofttimes remote from the urinary tract; the inflammation is invariably due to a mixed infection, from which in its chronic state it is commonly impossible to isolate the gonococcus.

2. The disease, analogous to pus-tubes in the female in many respects, presents serious and similar problems from the stand-point of treatment, and is not accorded the consideration that its medical importance demands.

3. The particular treatment in any given case should depend upon the anatomico-pathological state of the vesicles, ejaculatory duct and vas deferens. This can be determined by proper vesicular palpation, massage and microscopical examination, supplemented when necessary by vasopuncture and collargol radiography.

4. Experienced massage will in the majority of patients suffice to effect cure in due time; in many, however, massage having proved ineffectual, convalescence may be accelerated by vasopuncture, vasostomy and direct medication of the seminal vesicles; in certain cases, not so few as may be imagined, seminal vesiculotomy or vesiculectomy should and must be performed if we are to cure or relieve these patients of their annoying symptoms.

5. Bilateral vasopuncture and collargol medication has resulted at least in the temporary cure of a number of cases of persistent chronic seminal vesiculitis.

6. Collargol radiograms in a series of normal and pathological cases have demonstrated, (*a*) by comparison *in vivo* and *in vitro,* the graphic portrayal of an ejaculatory duct sphincter; (*b*) the intimate relationship between the ureter and seminal vesicle, whereby ureteral irritation and urinary obstruction may occur in the event of an enlarged and inflamed vesicle; (*c*) the presence of stricture or obstruction of the vas; (*d*) congenital anomalies of the vesiculæ seminales; (*e*) inflammatory enlargements of the vesicles, especially loculated collections of pus or seminal pyovesiculosis.

THE TREATMENT OF BLADDER PAPILLOMA BY HIGH FREQUENCY DESTRUCTION

By Alexander A. Uhle, M.D.
of Philadelphia

The destruction of living tissue by the local application of the high frequency current has been used with success in the treatment of tumors of cutaneous surfaces, and accessible mucous membrane. Dr. Edwin Beer was the first to successfully employ this method in the treatment of bladder papilloma. The application of an electric current of high tension on living tissue, produces various changes from simple hyperæmia to carbonization; terms such as fulguration, desiccation, high frequency cauterization, and thermocoagulation, have been applied to these thermic effects. Fulguration, first described by Dr. de Keating-Hart, is merely the production of hyperæmia in an operative wound by a bombardment of electrical sparks, and is never used for the destruction of tissue. As this term is usually used, it is a misnomer, and destructive fulguration is used by some to differentiate it. Dr. William L. Clark, of Philadelphia, originated the method of treatment by desiccation, which can only be produced by static apparatus, and describes it as the thermic effect produced on living animal tissue, which is within the extremes of hyperæmia and carbonization. If the accurate caloric degree is produced, controlled and sustained, it causes "a rapid dehydration of the part desired to be devitalized, rupturing the cell capsule and transforming it into a dry mass." High frequency cauterization refers to the destruction of tissue by carbonization. Thermocoagulation is another term used to express the same process. These last two terms have been employed irrespective of their exact meaning.

The high frequency current for desiccation can only be generated by a static machine of high output fitted with the proper requisites, while the high frequency current which causes destructive fulguration, high frequency cauterization or thermocoagulation, is generated by a coil apparatus transformed by proper accessories. The monopolar Oudin current is the one preferred by most operators, but the bipolar Oudin current may be used. The D'Arsonval is usually employed as a bipolar current and produces the same effect, but is more penetrating. In the former the entire body acts as a capacity, while in the latter the current is concentrated by the application of another pole opposite the area treated. When these currents are generated by the static machine with Leyden jars of a certain capacity, the effect produced

upon the tumor seems to cause less blanching and carbonization, and the resulting necrosis is by a process of pulverization rather than sloughing.

It has been the observation of all surgeons that the operative treatment of bladder papilloma is unsatisfactory, on account of the frequency of recurrence. Since the high frequency treatment has been employed, recurrences have also been observed and the future may prove them to be as frequent as following operation, but the simplicity of application, the rapid destruction of small neoplasms with a few treatments, and the fact that the patient is not subjected to any of the inconveniences or dangers of an operation, recommend this method of treatment.

The technic is simple: A catheterizing cystoscope is introduced into the bladder, observing the usual precautions of asepsis. The bladder is washed clean and distended with one of the usual mediums, and a specially prepared and properly insulated steel or copper wire is introduced through the cystoscope in a manner similar to the introduction of an ureteral catheter. The electrode most commonly employed is made of a single steel wire or several strands of copper wire, properly insulated, of a size to fit the ordinary catheterizing cystoscope; about an eighth of an inch of insulation should be removed from the end of the electrode, which comes in contact with the tumor. Wappler has recently made a special electrode, which has the advantage of being more durable and less flexible, and the tip is protected by a special insulation to prevent fusing. It requires, however, a Garceau type of cystoscope for its use. The electrode is introduced through the cystoscope, and is brought into direct contact with the tumor tissue; the proximal end is attached to the terminal of the high frequency generator. The strength of the current is regulated according to the size of the tumor, the effect desired, and the proximity of the electrode to the bladder-wall. The application should not be painful. A number of applications at different points, of from ten to twenty seconds duration, have been recommended. It has been our practice to attempt the entire destruction of a small growth with one treatment, going over the entire tumor with one continuous application, interrupting the current only to change the direction of the electrode. In large growths, an effort is made to destroy at each treatment as much surface as possible, depending on the tolerability of the patient. The immediate effects observed are the production of small gas bubbles at the point of contact of the electrode with the tumor mass, and the blanching of the tissue. The tissue thus destroyed sloughs away in the course of

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

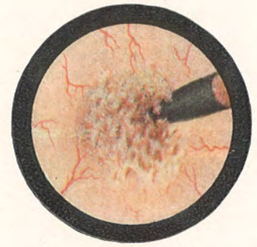


FIG. 6.

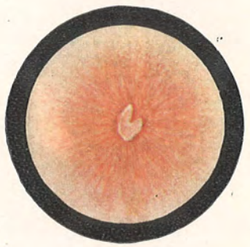


FIG. 7.

FIG. 8.

one or two weeks, and a cellular disintegration seems to continue for some time. In one patient we observed a rather rapid disappearance of a large papilloma in one month after one treatment, the actual sloughing having ceased in about ten days.

The frequency of treatment varies according to the size and density of the growth, and the local reaction. As a general rule, treatments should not be given more than once in a week or ten days. If marked vesical irritability follows treatment, it should not be repeated until the symptoms subside. Following the treatment of rather large tumors, the sloughing will continue for some time, and should be allowed to subside before another application is made.

The following is a brief report of the cases treated:

CASE I.—M. J. L., male, age thirty-four, referred by Dr. M. J. Leof.

In May, 1909, a suprapubic cystotomy was done for the removal of a large villous pedunculated papilloma, situated on the upper median portion of the bladder. The tumor, together with a portion of the bladder-wall, was removed. Recovery was uneventful. The patient returned for examination October 25, 1912, and stated that for two weeks he had frequent, urgent urination, with terminal hæmaturia. Cystoscopic examination showed a villous papilloma the size of a walnut, situated to the right of the median line, apparently in the line of incision, and a number of smaller papillomas on the right upper wall, and fundus of the bladder. Between October, 1912, and June, 1913, seven attempts were made to destroy the tumors, but only twice was it possible to bring the electrode in contact with the large tumor, because of its situation. Cystoscopic examination, October, 1913, showed a normal bladder. Cystoscopic examination, December 11, 1913, showed a recurrence of two small papillomas near the site of the former large growth (Fig. 1). One extensive application was applied to each of these tumors. Examination, January 27, 1914, showed the growths to have entirely disappeared, leaving at their former sites small hyperæmic areas (Fig. 2).

CASE II.—C. W. F., male, age thirty-eight, referred by Dr. John B. Deaver and Dr. W. F. West.

Date of first examination December 23, 1912. The patient complained of hæmaturia of two years' duration, following a fall from a horse. For several weeks following the accident, he suffered from a dull aching pain over the right kidney. Hæmaturia continued intermittently until September, 1912, when he had a severe chill, fever, and pain localized over the right kidney, accompanied by profuse hæmaturia, and was confined to bed nine days. Cystoscopic examination on the above date revealed four villous papillomas, the largest springing from the vesical mucosa, behind the orifice of the right ureter. Another on the left wall, a third on the base behind the interureteral ligament, and the fourth on the upper border of the internal vesical sphincter. A portion of the largest tumor was removed for miscroscopic examination, and found to be benign papilloma. High frequency current applied December 27, 1912, and January 23, 1913. Cystoscopic examination one month after the last treatment showed a normal bladder, both kidneys also normal. Examination January 6,

1914, one year after treatment: The bladder was found to be normal (Fig. 3), and showed a double opening of the left ureter, which was obscured by the papilloma.

Case III.—J. S., male, age fifty-eight, dye worker, referred by Dr. George Yeager.

Referred for examination June 23, 1913, because of intermittent hæmaturia of three months' duration. Cystoscopic examination showed a large villous, pedunculated papilloma of the left wall of the bladder behind the left ureter. A portion was removed for microscopic examination, and was found to be a benign papilloma. He received three treatments between June 23, 1913, and July 23, 1913, and was told to report for observation in a few weeks, but failed to do so. On December 2, 1913, in response to a letter, he returned for examination, and stated that he considered himself perfectly well. Cystoscopic examination showed the return of a small papilloma at the site of the former growth, which undoubtedly was not thoroughly destroyed by the previous treatments (Fig. 4). He received but one treatment, December 9, 1913. Fig. 5 shows the destructive effect of the high frequency current at the time of treatment; Fig. 6 shows a small denuded area of mucosa two weeks after treatment, and Fig. 7 shows the normal bladder seven weeks after treatment.

Case IV.—R. A., male, age forty-seven, referred by Dr. M. Abramovitz.

Referred August 22, 1913, for painless hæmaturia and frequent urination of six weeks' duration. Cystoscopic examination revealed a large villous papilloma occupying the entire right side and base of the bladder, extending forward beyond the internal sphincter into the deep urethra (Fig. 8), and a small papilloma on the left wall of the bladder. August 26, 1913, a portion of the tumor was removed and diagnosed benign papilloma, also received the first treatment on this date. He received two more treatments in the following six weeks. Cystoscopic examination, December 2, 1913, showed a normal bladder.

Case V.—J. J. S., male, age sixty, referred by and treated in conjunction with Dr. Wm. L. Clark.

Date of first examination, September 29, 1913. This patient suffered with frequent urination, and hæmaturia of a terminal type for six months. Cystoscopic examination showed a large sessile tumor on the left wall of the bladder, behind the left ureter, and surrounded by several small villous papillomas; this tumor had the appearance of a solid growth, and the pathological diagnosis was, that the tumor had the general appearance of benign papilloma, but in some places there was a tendency of the epithelium to invade the connective tissue, suggestive of malignancy. Seven treatments at weekly intervals were applied by a monopolar current from a static generator, devised by Dr. Clark. On November 26, 1913, about ten days after the last treatment, the tumor had entirely disappeared, but there was a roughening of the mucosa at the site of the large tumor. The patient has not been observed since.

Case VI.—J. M., male, aged fifty, referred by and treated in conjunction with Dr. Wm. L. Clark.

Date of first examination October 29, 1913. For several years the patient observed frequency of urination, and sensation of incomplete emptying of the bladder. In December, 1912, he noticed blood in the urine, since then he has had intermittent hæmaturia, usually lasting about a week, and never accompanied with pain. In October, 1912, a cystoscopic examination was made elsewhere,

Fig. 9.

Fig. 10.

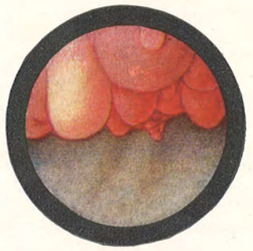


Fig. 11.

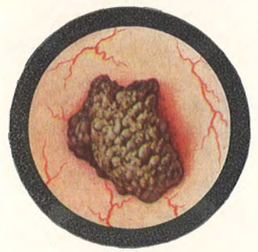


Fig. 12.

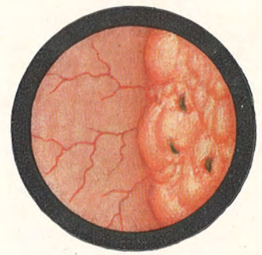
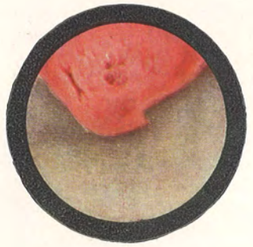


Fig. 13.



two papillomas were found and treated by high frequency destruction. Twenty-one applications were made at intervals of a few days. October 29, 1913, a cystoscopic examination revealed a villous papilloma the size of a hazel-nut on the upper left wall of the bladder, partly charred by the previous treatments, and a smaller sessile tumor, partly destroyed, on the base of the bladder, behind the right ureter. The bladder mucosa was congested. The prostate was not enlarged, and no strictures were found. There was considerable residual urine. October 30, 1913, complete desiccation of both tumors, with the assistance of Dr. Clark. Two weeks later, upon examination, found no evidence of the tumors. The mucosa was considerably injected. The patient is still under observation.

Case VII.—M. L., male, age fifty-eight, referred by Dr. T. LeBoutillier.

Hæmaturia observed for the first time one year ago, was intermittent for eight months, and constant for the past four months. Has constantly received medical attention. Two cystoscopic examinations were made by different observers, each of whom diagnosed a tumor. Since the last examination, four months ago, blood has been constantly present in the urine. Has slight loss of weight and marked anæmia. Cystoscopic examination, December 23, 1913, shows a large, sessile, non-villous tumor, occupying the entire left wall and fundus of the bladder (Fig. 9). The right wall is the seat of a peculiarly shaped tumor (Fig. 10). There is scarcely any part of the bladder larger than a silver quarter, which is normal. December 30, 1913, high frequency treatment, repeated January 15, 1914, and January 27, 1914. The patient is still under observation, the diagnosis is still in doubt.

Case VIII.—J. S., male, age fifty-one, moulder, referred by Dr. Harry Carmany.

Seven years ago the patient noticed frequent painful urination with hæmaturia and was examined for stone. This condition continued with periodic remissions to October, 1913. A cytoscopic examination by Dr. Carmany revealed tumor of bladder, and the patient was referred, October 15, 1913, for high frequency treatment. Examination on this date showed an extensive ulcerating tumor on the left wall of the bladder covered with blood clots. The base of the tumor was considerably infiltrated. A clinical diagnosis of carcinoma of bladder was made from the appearance of the growth, and was corroborated by microscopic examination of a portion passed. He received three treatments at weekly intervals, and two weeks later a cystoscopic examination showed a dense charred mass covered with phosphatic deposit lying free in the bladder (Fig. 11). The tumor was much reduced in size. Fig. 12 shows the condition of bladder-wall. Following this examination the patient suffered from marked hæmaturia and tenesmus, and was confined to bed for a week, during which time he passed a number of large clots. After this all symptoms disappeared and he considered himself cured. Cystoscopic examination, December 29, 1913, showed the tumor to have considerably increased in size, with all appearances of malignancy (Fig. 13). Patient has no symptoms, and has gained considerable in weight. He is still being treated.

In addition to the last case of carcinoma, three other patients with extensive malignant involvement of the bladder were treated, all were markedly cachectic. Two patients received two thorough treatments,

and one three. Bleeding was controlled for a few weeks, in each patient, but a fatal termination took place in all within a few months from the time of the first treatment.

A brief analysis of these cases shows that hæmaturia, intermittent or constant, is the most prominent, frequently the only symptom present. It is also interesting to note that it was of a terminal type in two cases. That hæmaturia, unfortunately, is still regarded as a disease, and not a symptom of some condition, usually a severe one, of some part of the genito-urinary tract, is evidenced by the fact that most of the patients were treated internally for some time, and no attempt was made to definitely locate the cause and site of the hemorrhage. The symptomatology is at times misleading, as symptoms may be referred to one organ, when the actual source of disease is another.

High frequency destruction of benign growths of the bladder is a very effective method of treatment, even when the bladder is extensively involved. Recurrences are frequent after any method of treatment, therefore cystoscopic examinations at stated intervals should be advised in every case of bladder papilloma. The immediate effects in malignant growths of the bladder are apparently good, as is shown by the diminution in the size of the growth, and cessation of hemorrhage, but a cure should not be expected; at least, this has been our observation with these few cases.

Dr. B. A. Thomas said that his experience had covered between twelve and fifteen cases and about 35 or 40 tumors; the reason for this excess of tumors over cases is because in one case in which the bladder was markedly trabeculated, there were no less than twenty tumors, from the size of a millet seed to that of a grape, scattered universally throughout the bladder. Even in that case it was possible to remove all of the tumors by this method. Perhaps a word should be said concerning the static machine *vs.* the coil in the generation of the high frequency current. In the first case treated by him the static machine was used, Dr. Wm. L. Clark supplying the electricity. That was in September, 1910, and was the first case in Philadelphia subjected to this form of treatment. The result in this case, together with the reports of a number of subsequent cases, was published in *Surgery, Gynecology and Obstetrics,* April, 1912.

Recently, in every case he had used the coil to generate the current, and so far as he could see, the effect is just as good as with the static machine, yet Dr. Clark claims the desiccating current can only be obtained with the static machine. With regard to recurrences, they have

not been as frequent as by incisional treatment, but in one case there have been two recurrences. By the high frequency current, when recurrences do occur, and he believed they were not prone to do so readily, the condition is amenable to a repetition of the same treatment, while there is a limit to the number of cutting operations which a patient can stand.

Dr. Hilary M. Christian called attention to the point brought out by Dr. Uhle regarding the importance of looking after cases of hæmaturia, and regarding it not as a disease but as a symptom of some underlying condition, almost always some condition in the bladder itself. It is most difficult to determine malignant from benign papillomata of the bladder. In his opinion two or three of these cases recorded by Dr. Uhle as malignant tumors had better have been left alone had they not been treated by the high frequency current. He would have liked to have heard more about the subsequent condition of these patients. Are they symptomatically cured, or are they really cured? His own operative work on papilloma of the bladder had been unsatisfactory, and if this method opens up any real field for radical work it is certainly promising.

Dr Thomas C. Stellwagen, Jr., said that in the clinic of the Jefferson Hospital Professor Hiram R. Loux and he had had several cases of papilloma of the bladder. The high frequency current used to treat these cases was generated by the coil type of apparatus. They had seen Dr. Clark demonstrate his static machine and they believe there is a difference in the mode of action of the current from the static machine and that from the coil machine. The current generated by the static machine will desiccate soap through a layer of delicate tissue paper without apparent injury to the paper. The current from the coil will not do this.

A completely practical electrode is necessary for intravesical work. This they have not as yet found. They have used the one made by Wappler, to which Dr. Uhle refers. Two of them have lasted but a short time. The mechanical principle of this instrument is practical, but the insulation has been unsatisfactory. The amount of current necessary to destroy an intravesical growth is apparently sufficient to puncture the insulation.

The treatment of papillomata of the bladder by fulguration is, in many cases, a radical and curative procedure. In the afore-mentioned series of cases there are four in which the growth has not returned after two years. Fulguration is particularly applicable to growths

adjacent to or involving the trigone. In this situation a resection involves very radical surgical procedures, such as transplantation of ureters, which are associated with a high mortality rate. Papilloma of the fundus, or dilating portion of the bladder, involving the deeper layers of the viscus and undergoing ulceration and necrosis, should, in our opinion, be removed by partial cystectomy. The involved wall and a portion of the apparently healthy surrounding tissue should always be resected with the growth. In such cases it does not seem possible to desiccate or fulgurate the affected area without danger of perforating the bladder and inducing peritonitis. To temporize with such a condition aggravates it and stimulates growth. These factors increase the danger of carcinomatosis. In Prof. Loux's Clinic such a case died of metastasis to the liver and kidneys. In this clinic he had recently assisted in the resection of two papillomas, both of which involved the deeper layers of the bladder. In neither of these does he believe that fulguration would have sufficed. In one of these cases, after six months, there was a small recurrence in the line of incision; this has been treated by the Oudin current with some success.

It is the practice of Prof. Loux to have every case of partial vesical resection carefully watched for any return of the growth. Upon the slightest intimation of any recurrence the area is fulgurated. This method they believe to be the most radical and the one that offers most for the subsequent cure of the case. It does not seem good surgery to allow a carcinomatous area to remain and expect no recurrence. Why could not the general surgeon expect a similar result in other regions such as the alimentary canal? He does not, and the man who cures cancer of the stomach is the radical surgeon; so the man who cures cancer involving the deeper structures of the bladder is the radical surgeon.

Dr. E. H. Siter said that he had had quite a little experience with fulguration and high frequency currents in papilloma of the bladder, and in answer to Dr. Christian's question, he did not think it would cure carcinoma of the bladder, but it reduces the hemorrhage and lengthens life. As to papilloma, it removes it. Perhaps Dr. Stellwagen has been in too much of a hurry, expecting to remove the papillomata in one application. One must have patience with the fulguration and the high frequency current must be applied a number of times. As a palliative measure, it has great advantages over cystectomy, in that the patient has not been subjected to the shock of an operation and the result is the same—that is, removal of the papilloma. Much cannot be expected of this treatment unless it is persisted in faithfully and patiently.

Dr. John L. Laird called attention to the fact that the apparently spontaneous disappearance of small papillomata on the treatment of adjacent growths is of frequent occurrence, and renders the direct treatment of such growths practically unnecessary. Whether this effect is due to transmission of the spark or its action through the intravesical medium or to trophic changes in the bladder wall, affecting the blood supply of the smaller growths, is not quite clear. He now had under treatment a case exemplifying this action. The patient was operated upon three years ago for a single large papilloma. There was a recurrence in the form of from thirty to forty smaller papillomata scattered over the entire bladder wall. At the first application of the high frequency current, all the larger growths on the left wall were treated. On examination two weeks later the larger growths had either disappeared or become much smaller and the smaller untreated tumors had entirely disappeared. Another illustrative case was that of a man with a diffuse papillary, villous growth extending over the anterior half of the trigone and into the deep urethra beyond the verumontanum. One treatment of a number of applications, certainly insufficient to reach directly all the tumors, produced a complete cure.

Dr. A. A. Uhle (in closing) agreed with Dr. Thomas that the results obtained with the coil apparatus are as satisfactory as with the static apparatus. There seems to be a difference in the immediate effects produced; with the static machine there is less sloughing and the detritus is more granular. Relative to the diagnosis one cannot state definitely whether the growth is malignant or benign. The appearance of the growth, the character of its base, and the condition of the surrounding mucous membrane are factors which must be taken into consideration. A portion of the growth can very readily be removed for microscopic examination. It should also be remembered that benign tumors frequently become malignant if not removed, and that malignant recurrences frequently follow the removal of a benign growth. Early treatment is therefore essential.

In reply to Dr. Christian relative to the condition of these patients after treatment he could state that the benign tumors were all cured with the exception of one who is still under treatment. The cystitis was aggravated in a few cases, particularly in one who had received 21 previous treatments elsewhere. Atony of the bladder was responsible for this condition. The cystitis was relieved in a short time by appropriate treatment.

CLINICAL MANIFESTATIONS OF POLYPS OF THE MALE URETHRA

By Alexander Randall, M.D.
of Philadelphia, Pa.

The question of the etiology of many of the chronic symptoms that a urologist is confronted with is often quite baffling. One continually finds one's self asking whether or not he understands exactly why he is persevering in a certain form of treatment and only too often the history gives telltale evidence that routine or surmise is the controlling factor. The day of treating in the dark, of feeling for a diagnosis, of deep instillations, and bulbous bougies, is fast fading before the light of visual endoscopic examination. The day of the "seeing eye" is superseding its less accurate, though valuable brother, the "feeling touch."

The subject herein treated is but another link forged to the chain of definite knowledge and pathology which may aid in the obtaining of an exact diagnosis in some of the apparently reasonless cases of chronic symptoms met with in urological work.

When one considers the frequency with which caruncle is found and diagnosed in gynæcological work, one cannot but wonder if a similar and analogous condition does not occur in the male. Yet a survey of the literature on the subject leads to the conclusion that though polypoid proliferation of the male urethra has been described, the frequency of the finding in no way keeps pace with the occurrence of caruncle in the female. While engaged in an active endoscopic clinic it was my opportunity to observe three cases of polyp of the male urethra in the short space of one month, and subsequent close observation soon raised this number, in the space of a little over a year, to nine cases, an analysis of which has appeared elsewhere[1] with especial attention given to their histological structure. I am now able to add five further cases to my experience. That these observations are not unique, I feel sure, for I find no less an authority than Oberlaender making the statement, twenty-five years ago, that he believed that urethral tumors in the male occurred as frequently as bladder tumors, or as caruncle in the female, and blames the apparent discrepancy on the lack of endoscopic study.

Etiology.—There is little to be said on the cause of such growths.

[1] *Surgery, Gynecology and Obstetrics,* November, 1913, p. 548.

Irritative conditions probably play an important part, as the tissue shows in some cases very active proliferation. The irritant undoubtedly may vary, for though the majority give a history of an antecedent gonorrhœa yet 4 patients denied the previous existence of any acute urethral discharge. That the histological structure varies suggests the possibility that the causes may likewise be of different natures.

Pathology.—Microscopic study of these polyps demonstrates that their structure varies markedly. Some are of loose fibrous tissue, with here and there a stray muscle bundle, and with blood-vessels coursing in the long axis of the growth. They are covered with an epithelium in no way differing from the normal mucosa of the urethra. In fact, the structure of this type of polyp is similar to that of the so-called mucous polyps as they occur elsewhere in the body. Others are definitely villous and active proliferation of papillary outgrowths is easily demonstrated. A third group presents the picture of enclosed glandular acini and deep infolding of the mucous membrane. In no case was malignancy suspected or demonstrated. With these findings at hand it was interesting to note that men studying the histology of caruncle in the female were also finding that they had to subdivide them into groups or types, whose histology varied (Williamson and Attlee).

Without troubling you with a close analysis of the pathology and histology of these specimens, nor the reasons why I have chosen so to subdivide them, I will present them classed into three groups, as follows: 1, Benign fibrous polyps, seven cases; 2, benign villous polyps, two cases; 3, benign glandular polyps, five cases.

Case I.—No. 1378. Age twenty-nine. Admitted April 7, 1912. Denies venereal infection. Complains of a slight discharge, a stinging pain during urination located at the penoscrotal junction, and also under the glans. He has pain at no other time and in no other place. These symptoms have existed for the last three or four years. Glass No. 1 and No. 2 clear. Bulbous bougie No. 27 F. detects an "infiltration" at about two and a half inches from the meatus.

July 3, 1912. Patient has been regularly treated, during the last three months with sounds, and has been twice cystoscoped, the bladder being pronounced negative. *Endoscopy:* Posterior urethra tender, colliculus is nodular and slightly irregular, walls of the urethra are injected and reddened. Utricle lies gaping in the midline. Silver nitrate application. Anterior urethra at about the suspensory ligament presents a polyp, hanging from the two o'clock aspect of its lumen; it is approximately one and a half centimetres long by one-half centimetre broad. Its walls are smooth. Removed with an endoscopic rongeur; 20 per cent. silver nitrate solution applied to its place of attachment.

July 11, 1912. *Endoscopy:* Site of tumor appears œdematous and slightly strictured, probably due to the caustic. No apparent growth.

July 25, 1912. *Endoscopy:* Posterior urethra normal. Area in anterior urethra that was cauterized is slightly strictured, due to œdematous mucous membrane.

August 30, 1912. Patient has been getting weekly dilatations with sounds and massage of the strictured area. *Endoscopy:* Posterior urethra normal. Site of polyp's growth much better and walls are but little thickened; central point is slit-shaped.

September 3, 1912. Glass No. 1 and No. 2 clear; no discharge; symptoms all gone.

Diagnosis.—Benign fibrous polyp.

Case II.—No. 58. Age ——. Admitted August 12, 1912. History of previous venereal infection not given. Trouble of five years' duration. Complains of pain at the onset of urination, some pain and discomfort in the perineum and suprapubic region. No other urinary symptoms. No discharge. Never masturbated or passed any blood; no sexual disturbance except nocturnal emissions at least once a week.

August 12, 1912. *Endoscopy:* Colliculus very tender and three times normal in size, back of the caput on the left superior wall of the urethra at about the two o'clock aspect of the lumen is a polypoid protuberance, white walled and distinct in color from the surrounding engorged urethral mucous membrane. It is about 6 mm. long and can be moved as if quite pedunculated, yet feels firm and stands outright from the wall. Seized with the rongeur and removed with some difficulty because of its toughness. Base cauterized with the silver nitrate stick. Anterior urethra normal. This patient has been lost to subsequent observation.

Diagnosis.—Benign fibrous polyp.

Case III.—No. 1144. Age forty-four. Admitted December 29, 1912. Has had gonorrhœa several times and now has a profuse discharge again. There is frequency and urgency of urination present, but no hæmaturia. Glass No. 1 and No. 2 cloudy. Received regular treatment for acute urethritis until the middle of May, at which time he had still a slight morning discharge, but no gonococci were present. Glass No. 1 slightly cloudy and glass No. 2 clear. The prostate was slightly indurated and fixed, with a few adhesions, not enlarged, not tender; prostatic secretion showed a few pus cells. No. 29 F. sound passes to the bladder with ease.

May 24, 1912. *Endoscopy:* Pendulous urethra normal, bulbus urethra shows marked infiltration and œdema, mucous membrane lustreless and quite thickened (beginning stricture). In the membranous urethra is a small polypoid growth arising from the eight o'clock aspect of the urethral lumen; same was successfully removed with a curette.

July 28, 1912. Patient has continued soundings and to-day his urine is quite clear.

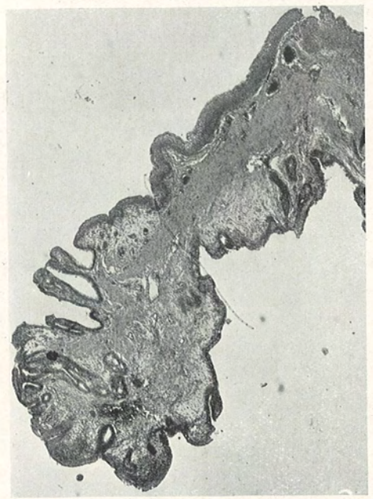
Diagnosis.—Benign fibrous polyp.

Case IV.—No. 564. Age thirty-one. Admitted February 19, 1913. Gonorrhœa five and seven years ago, no venereal sores. Complains that since "strain" two years ago he has a small swelling on the under side of the penis. This has not varied in size until three weeks ago, when it seemed to get larger and harder; and at the same time he first noticed a slight discharge. Urination was painful and it gave him a stinging sensation before its onset. Has seen

Fig. 1.

Specimen removed from Case II. It is a perfect example of benign fibrous polyp, showing the thin epithelial covering, the loose connective-tissue stroma and the blood-vessels. The constriction at the base is due to the bite of the rongeur. There is also a small area of round-cell infiltration significant of an infected gland follicle.

FIG. 2.



Example of benign villous polyp showing rather active papillomatous outgrowths. Specimen removed from Case V.

FIG. 3.

The proliferating villi in specimen removed from Case V under high magnification, showing delicate structure and definite papillomatous nature.

FIG. 4.

Specimen of benign glandular polyp removed from Case VII, showing a score or more of distended gland acini. The epithelium of the lumen of these glands shows no proliferative tendency. Some of the acini are markedly distended with a clear secretion.

FIG. 5.

Specimen removed from Case IX, showing active glandular hypertrophy with infolding of the walls of the acini. The picture closely simulates that of prostatic hypertrophy though of a much more delicate structure. The black area about the periphery shows the effect and penetration of 20 per cent. silver nitrate application.

no blood and has no chordee. There is no discharge visible. Glass No. 1 and No. 2 clear. Under the urethra is quite a hard nodule the size of a large pea and about one and a half inches from the meatus.

Endoscopy: In the region of the tumor a nodular swelling arises into the field from the floor of the urethra; the mucous membrane over it is pale and glassy, but not broken at any point. Just posterior to this area is a small pedunculated polyp standing upright from the floor of the urethra and about 8 mm. in length; it was seized with the rongeur and removed. The tumorous mass was twice deeply incised with an endoscopic knife from the urethral aspect, but no fluid was seen to exude.

February 28, 1913. *Endoscopy:* The nodule is possibly one-third smaller in size on external examination. From the urethral aspect the site of the polyp is covered with a lineal scar, while the point of incision into the mass is ragged and slightly ulcerated. This patient subsequently developed a para-urethral abscess, that was successfully opened and with its cure all symptoms abated.

Diagnosis.—Benign fibrous polyp.

Case V.—No. 1493. Age fifty. Admitted May 28, 1912. Has been treated elsewhere for a chronic urethral discharge and a "stricture," for the last two years. Complains of a "sensation" in the urethra, a mucoid discharge, and diminished sexual desire. *Endoscopy:* Posterior urethral walls are engorged. Colliculus is irregular and suggestive of some proliferative condition; it is hardly tender to the touch. Lightly curetted, and a protargol application. Anterior urethra shows signs of old sounding, being sclerosed in places and the lumen cavernous.

June 10, 1912. Says that he feels better and that he had an erection last night.

Endoscopy: Piece removed from the irregular area as it suggests a polypoid proliferation. Silver nitrate application to the remainder.

June 17, 1912. Since the last treatment the patient has had a most successful coitus, "as of old," he says, with a good strong erection and orgasm. *Endoscopy:* For the first time the place from which the growth was removed is definitely oriented and the ragged point proven to be about one-half of one cm. in front of (distalward to) the colliculus on the floor of the urethra, it was still slightly irregular and was touched with silver nitrate.

June 25, 1912. All symptoms gone and the patient reports himself as well. *Endoscopy:* Area again proven distalward to a slightly sclerosed colliculus and is still rough and crater-shaped, of about 5 x 5 mm. in extent. Cauterized.

Diagnosis.—Benign villous polyp.

Case VI.—No. 27. Age twenty-six. Admitted August 1, 1912. Gonorrhœa one year ago. Complains of pain suprapubically, slight frequency of urination and a slight glassy discharge from the urethra. Urination otherwise normal, sexual power and intercourse normal. Glass No. 1 and No. 2 slightly cloudy. Prostate is slightly indurated and very tender in the midline. Seminal vesicles negative. Prostatic secretion shows about 25 per cent. pus cells, also corpora amylacea and granule cells. *Endoscopy:* Colliculus enlarged, glary, sodden and lustreless; œdema is marked as is also tenderness. Silver nitrate applications. Anterior urethra normal.

September 10, 1912. *Endoscopy:* Still having pains. Colliculus smaller,

area about and above the utricular orifice is bilobular and pouting. Silver nitrate application.

October 1, 1912. *Endoscopy:* Posterior urethra about the same, colliculus a little smaller. Still having pains. Put on bi-weekly prostatic massage.

November 12, 1912. Discharge gone, but still having pains.

November 26, 1912. Colliculus still bilobular as above noted, appearing like two linked sausages above the utricular orifice. Iodine application.

January 29, 1913. Patient has been getting prostatic massage fairly regularly, with the subsidence of all symptoms except the pains. He states that the only relief that he has had from the pains has been after the urethroscopic application. *Endoscopy:* The apex of the colliculus appears as above noted; the protuberance completely removed with the endoscopic rongeur.

February 5, 1913. Has been free of pain for three days. *Endoscopy:* Caput is ragged and bleeds easily, but no protuberance visible. Silver nitrate application.

February 12, 1913. Has been perfectly well and free of all pain for the past week.

May 3, 1913. No symptoms present.

September 25, 1913. *Endoscopy:* Colliculus normal in outline and color. No sign of any proliferative growth. Patient is practically well though still under observation for chronic prostatitis.

Diagnosis.—Benign villous polyp.

Case VII.[2]—No. 1913. Age twenty-seven. Admitted April 30, 1912. Complains of "impotence" due to premature ejaculation, and poor erections. Sexual excitement without gratification during a number of previous years. Denies venereal disease. Urination is normal. Subject to pains across lower back. Prostate is quite indurated and adherent, its secretion contains a quantity of pus cells.

April 30, 1912. *Endoscopy:* On the apex of the colliculus is seen a prominently projecting polyp, standing upright and of fairly firm attachment and structure. It is situated a little to the right of the midline, about ½ cm. back of the mouth of the utricle, and is approximately 14 x 8 mm. in size. It was seized with an endoscopic rongeur and removed. Its point of attachment was cauterized with a silver nitrate stick. The remainder of the urethra is normal.

June, 1912 (from a letter). Following the removal of the polyp in this case the patient's pains disappeared entirely, though the sexual symptoms appear to have remained unimproved.

Diagnosis.—Benign glandular polyp.

Case VIII.—No. 542. Age thirty. Admitted February 10, 1913. Gonorrhœa five years ago with a gradual subsidence of the acute symptoms, but the continuation of a morning discharge to the present day. Has occasional frequency of urination, no pain, no blood. Nocturnal emissions always twice a week, often twice per night, and sometimes three or four nights in succession. Before he acquired gonorrhœa he would have a pollution once in three weeks, rarely oftener, and one year after the urethritis was contracted he began to have

[2] I am indebted to Dr. A. B. Cecil, now of Los Angeles, Cal., for this case, which he observed while in the service of Dr. H. H. Young, of Baltimore, Md.

them with increasing frequency until the present time. Glass No. 1 and No. 2 slightly cloudy (phosphates); prostate is small and not adherent, its secretion contains a few pus cells only. *Endoscopy:* Colliculus is normal in size and contour. Posterior urethral walls redden and bleed easily. One and a quarter centimetres in front of the colliculus and arising from the five o'clock aspect of the urethral lumen is a mushroom polypoid growth, low-lying and fairly well fixed. Excised with a curette and the base cauterized.

February 28, 1913. *Endoscopy:* Scar where growth was removed is one centimetre in front of the colliculus, the latter is in good condition. Anterior urethra is speckled with lenticular-shaped brown spots, especially along the roof of the urethra; they are undoubtedly infected glands, stained from the prolonged use of protargol. Some still exude a small droplet of purulent material.

March 6, 1913. *Endoscopy:* Has not had an emission during the last three weeks; has had no pain except a slight burning during urination. On examination, site of excision and the colliculus are normal, slight excretion of prostatic fluid (showing normal elements) into the tube. Treatment of chronic anterior urethritis to be continued.

Diagnosis.—Benign glandular polyp.

Case IX.—No. 166. Age thirty. Admitted September 18, 1912. Denies any venereal disease. Complains of a pale, glassy urethral discharge in the morning, of nine months' duration. Two months ago he passed some blood at the end of the act of urination. Has several preputial warts. Prostate is normal on rectal examination and its secretion is normal. Glass No. 1 contains a few mucoid shreds; No. 2 is clear. Bulbous bougie detects no stricture in the anterior urethra. Cystoscopy attempted but profuse bleeding renders observation impossible.

September 24, 1912. *Endoscopy:* Anterior urethra is normal. Posterior urethra is highly congested and the landmarks are difficult to observe. Colliculus does not appear to be enlarged, but everything is intensely engorged and bleeds on the slightest touch. Silver nitrate application.

September 30, 1912. *Endoscopy:* Condition about the same. Colliculus appears ragged. Silver nitrate application.

October 11, 1912. *Endoscopy:* After swabbing the posterior urethra with 20 per cent. silver nitrate the landmarks could be made out for the first time. What had been taken for the colliculus on previous occasions is a polyp situated about one centimetre distalward from the former, arising from the floor of the urethra in the midline; it is approximately 8 x 6 x 4 mm. in size; it was removed with the rongeur and the base not treated. External warts fulgurized.

October 15, 1912. *Endoscopy:* Area from which the growth was removed is slightly œdematous and about one centimetre distalward from the colliculus; it is healing nicely and nothing done to it. External warts have vanished.

Diagnosis.—Benign glandular polyp.

Case X.—No. 48. Age thirty-four. Admitted April 29, 1913. Contracted gonorrhœa ten years ago and has had recurrent attacks of a gleety discharge since. Notices shreds in his urine. Has recently recovered from an acute urethritis during which gonococci were demonstrated. (For certain reasons this man may be considered to be either auto-infectious or to receive reinfections from his consort.)

April 29, 1913. Smear from urethra shows many organisms, no gonococci.

Endoscopy: Tube passed after careful irrigation. Colliculus twice normal in size, appears sodden and firm, not tender. Painted with 20 per cent. silver nitrate. Anterior urethra show a follicular urethritis. Treated.

May 5, 1913. No discharge; urine clear except for one mucous shred. *Endoscopy:* Colliculus smaller and can now be entirely seen. It is paler and presents a most peculiar appearance. The apex is formed by a watery, jelly-like mass of clear translucent tissue, about this mass is a constricting ring of firm tissue, continuous with, and appearing the same as, the mucous membrane of the colliculus. This ring or edge can be raised on a probe's point and the whole resembles an acorn in its enclosing jacket. I should judge that it is a hypertrophic proliferation inside the utricular orifice and projecting from it.

May 12, 1913. *Endoscopy:* Same peculiar protuberance from the utricular orifice. Rongeur slipped under either lip and the mass removed with two bites. It was quite friable and caused but little pain. Amount removed measured approximately 10 x 7 x 5 mm. Colliculus cauterized.

June 2, 1913. Patient has no discharge, no subjective or objective symptoms. Urine clear. *Endoscopy:* Area about utricle still looks decidedly out of whack, yet I hesitate to do more than to give it a severe cauterization. Is to take one month's rest.

October 24, 1913. Has been perfectly well to date with the exception that for a few days he noticed a urethral discharge while he was also suffering from a severe cold. Urine clear. *Endoscopy:* Colliculus is pale, slightly sclerosed and no sign whatever of the old growth. Utricular orifice is slit-like, entered and washed out.

November 11, 1913. No signs or symptoms since last visit. No discharge, no abnormality of urination or sexuality. Prostate normal.

Diagnosis.—Benign glandular polyp, showing profuse proliferation.

CASE XI.—No. 81. Age twenty-one. Admitted November 12, 1913. Complains of pains in legs and arms, insomnia, nocturnal emissions. Has had gonorrhœa once, the discharge leaving him seven months ago; it was complicated with a right-sided epididymitis. For the past months has suffered from a marked feeling of lassitude, and difficulty to keep asleep, waking at about 2 A.M. and tossing about for the remainder of the night. Nocturnal pollutions became frequent three to four months ago. Now has three or four per week and as often as twice per night; no pain or blood associated with them. No discharge from the urethra.

November 17, 1913. Urine clear. One pollution three nights ago. *Endoscopy:* Urethra very sensitive and the passage of the instrument is arrested in the posterior urethra. The endoscope reveals a thick, dull, engorged and tense colliculus, about four times the normal size. Silver nitrate application.

November 24, 1913. *Endoscopy:* Colliculus less congested, and decreased in size. Suggests an intra-utricular growth, but this cannot be definitely made out because of the size. Cauterized.

December 8, 1913. One pollution in the last week; pains all gone; sleeping better. *Endoscopy:* Colliculus still larger than normal, dusky and thick looking. The intra-utricular growth again observed; it can be pushed back within the utricle, whereupon the lips close and appear as a normal orifice. Severely cauterized with the caustic stick.

December 17, 1913. Has been free of all pains, sleeping decidedly better, and only one pollution during the last week. *Endoscopy:* Colliculus still larger than normal and the growth protruding from the utricular orifice. Probe can be passed almost entirely around it. Alligator forceps carefully placed on either side of the mass, and the same removed in one piece. Base cauterized.

January 17, 1914. Sleeping practically normally. No pains and has had one pollution in the past month.

Diagnosis.—Benign glandular polyp, showing active proliferation.

CASE XII.—No. 1143. Age thirty. Admitted October 28, 1912. Has had gonorrhœa three times without any complications. Married. In 1910 gradual impairment of sexual power began and for the last nine months has been practically impotent; a slight erection is possible but introitus cannot be accomplished. There is a marked prostatitis present, and the prostatic secretion is loaded with pus cells. Patient put on a course of prostatic massage, which was persisted in for four months. During this time he had a few endoscopic applications of silver nitrate. His impotence has been but slightly benefited and on February 4, 1913, he stated that he thought that the urethroscopic cauterization did more good than anything else. No discharge from the urethra.

February 11, 1913. *Endoscopy:* Apex of the colliculus appears practically normal, but back of it and arising from the right side of the verumontanum is a small polyp, about 6 x 3 mm. in size. It was cauterized.

February 18, 1913. Feels better. *Endoscopy:* Polyp still present and not decreased in size. Polyp removed with endoscopic rongeur.

March 15, 1913. Urine clear. Feels much better. Has sexual desire and erections every night and often during the day. Better and stronger than in the last two years.

April 4, 1913. Sexual power remains good. Intercourse can be accomplished, and though somewhat weak, orgasm is present.

Diagnosis.—Benign fibrous polyp.

CASE XIII.—No. 323. Age sixty-nine. Admitted November 25, 1912. This patient entered the hospital at the above date and was found to be suffering with benign hypertrophy of the prostate for which he was operated upon in December, 1912, by suprapubic prostatectomy. Since the operation and his complete recovery, he has been complaining of an itching sensation in the perineum, associated with an urgency and slight frequency of urination, having to still get up once per night.

January 17, 1914. *Endoscopy:* Posterior urethra is quite roomy, its walls are slightly congested. Into the lumen of the tube hangs a long thin polyp of at least 1½ cm. in length. It is attached to the right lateral wall of the prostatic urethra. Removed with the rongeur.

Diagnosis.—Benign fibrous polyp.

CASE XIV.—No. 308. Age thirty-two. Admitted November 11, 1912. Complains of a delay at the onset of urination, which latter requires force to start, stream of poor size and dribbling at the end of the act. There is a slight discharge at times, though patient has never had an acute urethritis. No frequency, no blood. Glass No. 1 and No. 2 slightly cloudy. Treated for chronic urethritis during December, 1912, and again from July, 1912, until September 24, 1913. *Endoscopy:* Posterior urethra back of the colliculus presents a gen-

eralized bulbous swelling, this is especially marked about the vesical orifice; condition taken for cystitis colli proliferans œdematosa (Zechmeister and Matzenauer). Iodine application.

October 2, 1913. Urine clear. *Endoscopy:* Posterior urethra better; the swelling is glassy and the blebs rounded and tense. There is possibly a polyp on the floor of the urethra between the colliculus and the vesical orifice. Silver nitrate application.

October 15, 1913. Colliculus but slightly larger than normal; on the left of the urethra, back of the apex of the colliculus and arising from the sulcus between it and the urethral wall, is a pale polypoid growth of about 8 x 3 mm. in size; it is freely movable. Removed with the rongeur. Silver nitrate application.

November 3, 1913. *Cystoscopy:* The internal vesical orifice is encircled by polypoid proliferations lying within the sphincter. These were fulgurized with the high frequency current.

November 10, 1913. *Cystoscopy:* Remaining proliferations again treated with the high frequency current.

November 26, 1913. *Endoscopy:* Vesical neck appears perfectly clean of all proliferative growths. It is slightly irregular but no polypoid masses.

Diagnosis.—Benign fibrous polyp.

Symptomatology.—Although presenting these cases divided into three classes according to their pathological structure, it in no way signifies that such groups present differences in the symptoms that they give. There is no grouping of symptoms that may be called pathognomonic of urethral polyp.

Discharge: In this series seven patients gave a history of a previous gonorrhœa, four denied having had an acute urethritis; in three the history on this point is lacking. However, nine complained of a chronic discharge, generally of a mucoid nature, in none of which was the gonococcus found. Four were recovering from their first, or a recurrent acute attack, and four claimed that the acute urethritis had gradually subsided and for varying periods of time a gleety discharge had been present. In the patients who complained of no discharge the growth was in the posterior urethra.

Hemorrhage: Urethral bleeding was present in but one patient as a spontaneous occurrence, though several of the patients had had bleeding after instrumentation. This is a point that may be emphasized, that spontaneous bleeding is rare, judging from this series of cases.

Pain: Various pointed, reflex, and radiating pains, sometimes dull and at others sharp, some during and others only after urination, the majority presenting vagrancies too numerous to mention, were practically always present. This may be explained on various grounds, but

especially must be borne in mind the type of character and the duration of symptoms presented by these chronic invalids. It is significant that two complained of a sensation as though a foreign body were present and one graphically described a thrill which he felt in the anterior urethra during urination. Pain occurring at the onset or the end of urination speaks for a lesion in the posterior urethra, as does also frequency and urgency of urination. But the majority have vague pains, itching or sticking sensations, difficult to locate exactly, but situated at times in the region of the perineum, often suprapubically, rarely as though in the rectum. These rather definite pains are frequently associated with sacral aches, "tired backs," and radiating pains to the hips and thighs.

Sexual: Six of these patients complained of abnormalities in their sexual life. Polyps when occurring in the posterior urethra nearly always cause some disturbance in the sexual sphere. This is hardly to be wondered at when one considers the irritation such a condition would excite in the neighborhood of the sensitive verumontanum. This latter structure, supposed to be of erectile tissue, under such an abnormal stimulus would be the point of starting the sexual cycle, so that frequent pollutions, such as presented by one of these cases, where they occurred three or four nights in succession, often twice in one night, and always three times a week, are not strange. The symptom of premature ejaculation similarly may be due to an added irritant sending centripetal stimuli to the ejaculatory centres. Likewise, decreased sexual power, amounting at times to partial impotence, may be accounted for by the inertia following a long period of irritation to the point of exhaustion, not infrequently seen in the latter stages of long standing cases. Of the 6 patients who complained of various sexual symptoms, in every one the growth was in the post-urethra.

Technic.—The mode of cure used in these cases has been that of radical removal. In some I tried repeated cauterization with silver nitrate, but it proved inadequate. In others the high frequency current was tried and not only by this means were some beautiful specimens, for microscopic study, destroyed, but it was also found troublesome to control when working in such a small space and often quite painful to the patient.

I prefer to use the plain open (air) straight endoscope of 24 or 26 French calibre, whose sterilization can be simple, rapid and sure, as I hold that a perfect aseptic technic is very essential to good and prompt results. The removal of the polyp is accomplished by means of either a snare or a delicate alligator rongeur forceps. The snare is a simple

one, similar to Blake's nasal snare, I believe, with a shaft made the necessary length, and the instrument slightly more angulated. The alligator forceps is the better instrument to use if possible, and if made slender with biting rongeur blades accurate work, rapid removal, and splendid specimens may be obtained. In the posterior urethra following removal, I nearly always touch the point of attachment with either 20 per cent. silver nitrate, or the pure crystal fused on the point of a probe. It is always quite essential thoroughly to dry the area with cotton, after the use of strong caustics, thereby localizing their effect and saving the patient much discomfort. In the anterior urethra experience has taught me to leave the caustics alone, unless very limited effect is obtained by accurate application. In one patient I produced a temporary stricture of the anterior urethra by using a strong solution of silver nitrate too copiously and getting an annular swelling of the mucous membrane.

Conclusions.—Chronic symptoms arising from the urethra are practically always due to changes of a very local character in some part of the canal. The appropriate treatment of chronic urethritis depends entirely upon an accurate diagnosis. An accurate diagnosis depends upon a visual examination. The day when Guyon said that a urologist should have his eyes in his finger tips, or better yet at the end of his sound, is passed. The laryngologist no longer treats laryngeal inflammation by only prescribing a gargle. He examines visually, treats locally, and thereby diagnoses accurately. To-day one should no more attempt the treatment of chronic urethral discharge without the endoscope than he would an acute urethritis without a microscope. The subject of urethral polyp is but one of the things, one of the entities, that we have sifted out of a long line of symptoms, generally so vague, so obscure, scattered yet closely associated, individually often unimportant yet collectively ofttimes leading the patient to a very bitter existence, and the bright spot is, that it is easily and completely remedied by appropriate treatment.

Dr. Hilary M. Christian recalled three cases of chronic anterior urethritis treated by himself by the ordinary high dilatation method, where the underlying factor in each case was a urethral polyp found by the urethroscope after five or six weeks of treatment with dilatation. He was very much interested to hear Dr. Randall's points brought out associating the tumors in the posterior urethra with sexual neuroses. This is a very important matter and it is one that neurologists are inclined to overlook and to put the patients down as maniacs or neuro-

paths, while the probabilities are that underlying a large part of these men's troubles there is some condition of the posterior urethra which the urethroscope will divulge.

Dr. B. A. Thomas related the history of a patient who had never had a neisserian infection. He was markedly neurasthenic. He was in the habit of urinating every few minutes, twenty to thirty times a day. Endoscopy revealed a definite tumor which even with the urethroscope could be diagnosed as a solid tumor, a fibroma, situated on the posterior part of the verumontanum. After cocainizing it with 10 per cent. cocaine introduced through the sheath of Young's prostatic punch, he then readily and painlessly removed the growth by means of this instrument. The symptoms at the present time are *nil.*

HOW SHALL THE CLINICIAN INTERPRET THE WASSERMANN REACTION?

By William H. MacKinney, M.D.
of Philadelphia, Pa.

At the present time it may be said that the attitude of clinicians toward a Wassermann reaction has divided them into three groups:

Those who depend absolutely upon a Wassermann for diagnosis.

Those who discard a Wassermann reaction as of no value.

The third group, who from their experience in syphilis, and a careful study of the Wassermann reaction in every case of syphilis, of many reactions made by different serologists, and by series of reactions made at frequent intervals upon patients under treatment, have learned what to expect in practically every phase of the disease.

Of the three groups of clinicians, the first are the most dangerous, as to interpret a positive Wassermann as a positive indication of syphilis is erroneous. The second group, while less dangerous, deprive their patients and themselves of a most valuable adjunct in diagnosis, prognosis and treatment. The third group are those who are prepared to give themselves and their patients the advantages of the numerous important data that may be obtained from a properly performed test, and at the same time safeguard him against the evils, which might result from an incorrect interpretation of the same. From a careful study of a great number of reactions made upon those suffering with syphilis, in all stages of the disease, and under nearly all types of treatment, a number of conclusions may be drawn, which will be of assistance to the clinician in checking up the accuracy of a Wassermann report.

In our observation, the Wassermann reaction in the initial stage of syphilis never became positive before the fifth day, and was always positive in cases seen after the fifteenth day. To wait for a positive Wassermann reaction to confirm the diagnosis of a clinically suspicious ulcer, deprives the patient of the one time in the whole course of his disease, that a rapid and almost certain cure can be expected. The same may be said of clinical diagnosis, that usually when the clinical diagnosis is without question, it is too late to expect a rapid and certain destruction of the spirochætal infection. The diagnosis should be made from the presence of the spirochæta which are most easily detected by dark field illumination, and the Wassermann test should

guide the prognosis. We have never observed syphilis to become a constitutional disease, either clinically or serologically, when energetic salvarsan or neosalvarsan treatment was instituted in a chancre with a negative Wassermann. From the above it may be deducted that the Wassermann as a diagnostic means in primary syphilis is of minor importance compared to its value in prognosis. Positive spirochæta pallida is diagnostic of the initial lesion, and should always check up a positive Wassermann or clinical judgment. A positive Wassermann in conjunction with a positive spirochæta pallida announces the onset of constitutional syphilis, and alters to a considerable degree the prognosis.

In secondary syphilis, untreated, the clinical judgment usually suffices for diagnosis, and the properly performed Wassermann test confirms it, but the clinician who neglects its performance, deprives both himself and the patient of valuable data that may be used in prognosis, and as a guide as to the efficiency of treatment. A properly performed test not only tells us that the patient has syphilis, but the degree of constitutional infection, or amount of natural resistance. It is, indeed, surprising how variable is the degree of positiveness of the serum reaction in patients with syphilis in similar stages of the disease; as a rule, the higher the degree of positiveness, the more energetic and prolonged must the treatment be to reduce it to negative, and so much more zealous the physician must be to guard against clinical relapses. When in clinically doubtful manifestations of secondary cutaneous syphilis the Wassermann is positive, the clinician has a perfect right to reject the Wassermann in favor of his clinical opinion, until by the subsequent course of the case, he proves to his satisfaction that syphilis does or does not exist. He should also in the best interest of the patient submit the blood to different serologists. The report that he obtains will give him valuable information as to the element of "personal equation," which always exists in the work of human hands; however, the possibility of a latent coexisting syphilis must always be thought of.

In active tertiary syphilis, again the Wassermann usually confirms the clinical picture, but, as in the secondary stage, is of value in prognosis, and as an index to treatment. Clinical experience and the Wassermann reaction teach us that tertiary syphilis is difficult to eradicate and relapses, both clinically and serologically, are frequent, and that a reasonable assurance of cure is but a remote possibility. To obtain a negative Wassermann with treatment of any kind, requires that the treatment be very energetic and prolonged.

The Wassermann reaction has confirmed the clinician in his views, that hereditary syphilis is least influenced by any form of treatment, and has thrown considerable light upon the etiology of many of the diseases of special organs, notably the eye, ear, brain and cord, which were formerly more or less obscured. In syphilis of special organs, the interpretation of the accuracy of a Wassermann reaction must be left to those familiar with the clinical manifestations of the disease, as it must be left to the syphilologist in the manifestations of general constitutional syphilis. In the presence of questionable lesions of syphilis, we regard the Wassermann reaction as of subsidiary importance to clinical experience, from the diagnostic standpoint, and no physician should accept a positive Wassermann as a positive indication that the patient has syphilis, but should regard it as but one of the symptoms or signs of the disease, which goes to build up the general clinical picture as ascertained from a careful history and physical examination of the patient. In the absence of clinical symptoms, the Wassermann reaction again should not be absolutely relied upon, for as in the present day many are pronounced syphilitic upon the strength of a positive Wassermann test, so in days gone by were they adjudged syphilitic upon insufficient clinical data, and it is here that the most careful history regarding the character of the lesions upon which the diagnosis was based, the time at which the treatment was begun, the method employed, the length of time continued, the occurrence of lesions which indicate relapses must be sought for, and the probabilities for or against infection established in the clinician's mind. When the probabilities of syphilis and the reaction agree, all well and good, when they disagree the blood should be sent to different serologists before judgment is pronounced.

The influence of treatment upon syphilis, from the standpoint of serum reaction, depends upon when treatment was instituted, how long it was continued, the drugs employed, and the method of their administration. One thing is certain, syphilis as treated in the past has not been efficient, its prevalence and the number of diseases caused by syphilis is proof of this assertion. A two or three years' course of mercury treatment is only followed by a negative Wassermann in fifty per cent. of cases. A negative Wassermann of a patient under treatment is not an indication of a cure, but is an index of the efficiency of the treatment, and our aim should be to reduce the Wassermann to negative in the shortest time by most energetic treatment, and so maintain it over an indefinite time, as evidenced by repeated negative reactions. In a patient so treated, a positive Wassermann reaction following one or a series of negatives is the earliest indication of the activity of a heretofore latent infection.

In conclusion, it may be stated that the serum reaction, properly performed, is such a valuable aid to the clinician, that it should be made only by those thoroughly trained in serology. The clinician should never rely upon the Wassermann reaction absolutely in diagnosis. As the serum reaction offers the possibility of so many errors in technic and reagents, it is essential that the closest relationship should exist between the clinician and the serologist, in order that accurate and reliable results may be obtained. As clinicians, we strongly urge that a uniformity in technic and a standardization of reagents be adopted by serologists. From our experience with the serodiagnosis, we have found the "single unit system," as introduced by Dr. John L. Laird, to furnish the clinician with the most accurate data, for by this method the exact quantitative results as expressed in units can be estimated.

STATED MEETING, HELD MARCH 2, 1914.

Dr. John H. Gibbon, President, in the Chair

BONE TRANSPLANTATION (ALBEE OPERATION) FOR SPINAL TUBERCULOSIS

Dr. James K. Young reported the following cases:

Case I.—David S., aged twenty, male, born in Russia, was admitted to the Polyclinic Hospital, November 21, 1913, suffering from tuberculosis of the spine in the lumbar region.

Previous History.—Two years ago while at work in the country, in Russia, he was injured by being thrown against a door and striking his back, was confined to bed for one week, and worked one week, when he noticed the bone projected backward; he was advised by a physician to have an apparatus applied, but refused. The deformity increased and he was unable to work.

Present Condition.—On admission there was marked kyphosis in the lumbar region, including the first and fourth lumbar vertebræ, with deferred pain and weakness, but no paraplegia. On November 22 Dr. Young did a bone transplantation operation, taking the graft from his left tibia. The convalescence was uneventful. He wore a plaster case ten weeks and has since worn a brace. The symptoms disappeared and the spine is ankylosed.

Case II.—John B., colored, male, aged twenty-four, was referred to the Polyclinic Hospital by Dr. David Reisman. In addition to a tubercular lesion of one of his pulmonary apices he had a well defined tubercular kyphosis in the dorsal region. The usual signs of pressure, pain and muscular spasm were present, but no paraplegia. On June 18, 1913, was done a bone transplantation operation, taking the graft from his tibia; a plaster-of-Paris cast was worn for seven weeks. There was nothing unusual in the convalescence and a fixation of his spine caused an improvement in his symptoms. Upon removing the cast he was not entirely free from symptoms and a spine brace has since been worn. The spinal lesion appears to have been arrested.

Case III.—Rose L., Russian Hebrew girl, aged nineteen years. Was admitted to the Polyclinic Hospital December 12, 1912, for dorsal Pott's disease with paraplegia. She had had the deformity for eight years, part of which time she had worn a spine brace

and head piece. She was without any efficient support most of the time. The kyphosis was angular and large, including the fourth to ninth dorsal vertebræ. There was loss of patella reflexes, marked ankleclonus with marked motor palsy of the lower extremities. She was very anæmic and weak, but there was no suppuration nor amyloid disease of any of the internal viscera. On December 13 bone transplantation, using a graft from the tibia, modeled to fit the curve. During convalescence the wound in the leg attracted her attention more than the spinal incision. She was in bed four months in a plaster case, since which time she has worn no support, her paralysis has disappeared and her spine is ankylosed.

The technic of Dr. Young does not differ from that of the inventor Albee, except in a few non-essentials. A curved incision is made in the dorsum on the right side and the left side of the spinous processes is separated with a chisel. This insures a good covering over the spinous processes and prevents gaping of the wound. Kangaroo tendon sutures are used in the fascia, the bone from the tibia is removed with an osteotome, and by team work of the assistants the time of the operation is diminished: the Resident Surgeon assists while the spine is prepared, the graft being removed by the first assistant with the aid of a second assistant. Then the first assistant takes the place of the Resident and holds the bone in place while the wound is closed. A support should be worn until the akylosed spine can support the weight of the body, at least 9 to 12 months. In selected cases the recovery seems to be more rapid from earlier ankylosis. It should not be performed in children under eight, in incipient cases without deformity, or where efficient apparatus can be worn.

An abscess or discharging sinus in the region of the incision would complicate the operation. Amyloid disease would not be a contra-indication, but would render the ultimate prognosis less favorable.

Dr. J. Torrance Rugh said that he would not make the age limit quite the same as did Dr. Young. He believed the operation to be especially indicated after the twelfth or fourteenth year, and for the older class of patients it is the ideal operation. There is one feature of the operation which, however, has brought rather disastrous results in a certain number of cases, and that is that the graft is made too short. It does not extend a sufficient distance above and below the site of disease to give a firm hold and a firm support, and the cases which have done badly and where the deformity seems to have recurred, have been due to that fact.

The method, as shown by Albee, is to expose the spine, prepare the site for the insertion of the graft, and then measure the length of graft desired and take it from the leg. It would be difficult to gauge the exact length of the graft needed unless the area for the insert has already been exposed.

In the younger cases, under twelve years, the Hibbs' operation has a distinct place. This consists in the utilization of the spinous processes for securing a bridge of bone along the posterior column. In a case in which a total paralysis had been present for eight months this disappeared absolutely in about two months after a Hibbs' operation and the patient is now walking about with practically no support and with a good firm spine. The Hibbs' operation is very easy in the child but difficult in the adult.

Dr. James K. Young (in closing) said, in regard to the size of the graft, he used a wooden sterile tongue depressor on which he measured the vertebræ, and his assistant was then able to take out the part marked while he was preparing the spine for its insertion. The operation is easily performed in twenty minutes. He had found the osteotome better than the electric saw.

There is no age limit, but the shock is less after eight years of age.

He takes the periosteum with the transplant, and Dr. Albee suggested always scarifying the transplant in the longitudinal direction, while Dr. Galloway suggested scarifying it in the opposite direction, so he scarified it in both directions so that the osteogenetic layer of the periosteum of the graft will unite with the bone of the vertebræ.

A TREATMENT FOR OLD CONTRACTED CICATRICES

By Emory G. Alexander, M.D.

of Philadelphia

clinical professor of surgery, women's medical college; associate surgeon, episcopal hospital

There is scarcely any condition in surgery that so tests the patience, ingenuity and skill of the operator as the treatment of old cicatricial contractures. Especially is this true if the cicatrices are hard, dense and of long duration. It is not my object to review what has been done in the past in the field of plastic surgery, as the method of procedure in each case must be determined on the local findings. In one case the division of contracting bands may suffice, in another the sliding, twisting or transplantation of flaps, to take the place of the excised cicatrices may be required. In still other cases, especially of the extremities, the deformity may be so great as to require amputation.

Are bad cicatricial contractures following burns as frequent as they were a generation ago? Our present-day text-books on surgery would lead us to believe that they are not, as little attention is given to this very important subject. Possibly we have improved in the treatment of burns, certainly, antiseptic dressings and early skin grafting has reduced to a large degree the late bad effects.

It is often difficult and sometimes impossible in cases of cicatricial contractures to get healthy flaps, and if one be so fortunate as to succeed, the result is always in doubt, as the flap may slough on account of a deficient blood supply.

In old, dense cicatrices, the result of deep burns, plastic operations are not without risk, as important structures, such as nerves and blood-vessels may be caught in the scar tissue and their anatomical situation so disturbed as to render injury almost unavoidable.

The case I wish to present to-night was not treated by the usual method of plastic surgery. In this case a plastic operation has been done at the wrist and axilla with much improvement; at the elbow, where an old firm cicatricial contracture existed, a good result has been obtained. This result has been obtained, not by the usual method of dissecting out the cicatrices and the lateral approximation of healthy skin, nor by the sliding, twisting or transplantation of flaps, but by operative, medicinal and mechanical means.

E. F., aged seventeen years, white, was admitted to the Episcopal Hospital on May 16, 1913, with the following history:

At the age of 14 years he received a severe burn of the left

side of the body, arm, forearm and hand. The patient was 18 months recovering from the burn. He was treated for ten and one-half months as an inmate in a local hospital in the town in which he lived, and for seven months after being discharged from the hospital, in their dispensary.

A physical examination of the patient on admission to the Episcopal Hospital showed the heart, lungs and other organs to be healthy. The left wrist was in extreme flexion, the joint ankylosed, and the overlying skin and cellular tissue consisted largely of scar tissue and contracting bands. The fingers could be freely moved. The thumb was partially ankylosed. The left elbow was markedly flexed and held by contracted bands of hard cicatrices. The left arm was held close to the chest wall by a large web of contracted scar tissue. The shoulder, chest and abdominal wall, and the latter anteriorly, showed contracted cicatricial tissue.

On June 12, 1913, a plastic operation was performed at the wrist, as his hand was so markedly flexed as to render it useless. At this operation an arthrectomy (first row of metacarpals removed) and a plastic operation were performed. The result was quite gratifying, as shown in Fig. 1. An arthroplasty on the wrist is the next operation we intend to perform. One month after the above operation the patient was discharged from the hospital in the condition as shown in Fig. 1.

On November 14, 1913, he was again admitted to the Episcopal Hospital, and on November 17, 1913, was operated upon and a plastic operation of the flap, sliding type, was performed on his axilla, the flap being gotten from the pectoral region. On his arm and forearm a different procedure was tried, many incisions were made along the contracting bands. These incisions extended into the healthy skin laterally and were of varying depth, some being quite superficial and others being deep enough to penetrate the cicatrices. After the wounds had ceased to ooze, fibrolysin, a compound of thiosinamine and sodium salicylate, was next rubbed thoroughly into each incision and also injected hypodermatically into the fibrous tissue. The wounds were covered with rubber tissue and a dry dressing applied. A straight splint, padded mould-shape to take up the concavity caused by the flexed elbow, was applied. The bandage holding the splint was firmly applied, so as to extend the forearm as much as possible.

For two days following the operation the patient complained of pain at the elbow. This was undoubtedly due to the extension made on the forearm.

In one week's time quite an improvement was noticed. The forearm could be extended fully fifty per cent. further than it

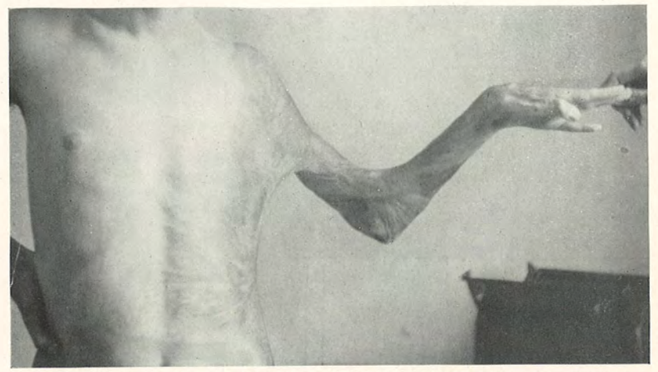


FIG. 1.—A plastic operation has been done at the wrist. Axilla and elbow show dense, contracted cicatrices.

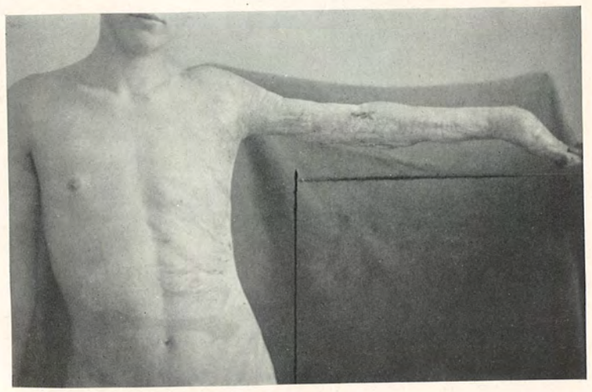


FIG. 2.—End result.

FIG. 3.—Back view.

could before the operation and the cicatrices were soft and pliable.

On December 4, 1913, the operation as described above for the administration of fibrolysin was repeated. After this operation the patient experienced nothing like the discomfort which followed the first. In ten days' time the arm was as straight as you see it now (Fig. 2). At each operation the contents of four ampoules of fibrolysin were rubbed into the incisions and injected into the cicatrices.

The after-treatment has consisted in the occasional injection hypodermatically of the fibrolysin into the site of the old cicatrices. Passive motion and massage have also been given. Three and one-half weeks following the second operation the splint was removed, but as the forearm showed a tendency toward flexion it was reapplied.

It is as yet too early to say what the ultimate outcome will be, as the tendency to contraction after the splint was removed has made me a little skeptical. No reactions were noted from the use of the drug.

Richardson, ANNALS OF SURGERY, December, 1911, in an article entitled "Studies on Peritoneal Adhesions," discusses the results obtained by specific drugs in the treatment of adhesions and cicatrices. He says, "Sidorenko has just reported the results of a clinical, experimental, and histological study of fibrolysin on cicatricial tissue. From a critical study of the results of other workers, and from his own results, he concludes that it does not exert any therapeutic effect upon cicatricial tissue."

A. H. Tubby, *British Medical Journal,* November 8, 1913, described a method of treatment of Dupuytren's contracture by flap dissection, excision of the affected fascia and the use of fibrolysin. While not following Mr. Tubby's technic, it was from his article that I got the idea of using fibrolysin in the way as described in this case.

Mr. Tubby, in speaking of his operative results in the treatment of Dupuytren's contracture, says, that in every case they were "infinitely superior" to those in which the thiosinamine (fibrolysin) was not used.

In the case just presented it is difficult to attribute the success to any one thing, as three distinct measures, operative, medicinal and mechanical were used. That the cicatrices were rendered soft and pliable lends weight to the drug.

DR. JAMES K. YOUNG said, in regard to fibrolysin, he had had some experience with its administration, and had found it could be used quite extensively. He had given one patient 94 injections without any bad effects. The drug is often tasted in the mouth, so that evidently

it goes through the body, and in arthritis deformans it has a peculiarly happy effect on the joints, as the ankle, knee, wrists, etc. He called attention to a treatment by Parker, of Chicago, for the prevention of scars after burns. He showed several patients he had treated by strapping with zinc oxide plaster and fixing the parts in plaster-of-Paris splints. This plaster was removed at intervals, and by keeping the elbow, axilla, and groin straight and fixed, contractures did not occur in the patients shown.

Dr. J. Torrance Rugh said that he had had some experience with the use of fibrolysin. He had the privilege of seeing one of Mr. Tubby's cases last summer and in that case Mr. Tubby did not dissect out the scar tissue in Dupuytren's contraction, but simply scarified the parts and rubbed in the fibrolysin, and the result was a most satisfactory one and there was complete correction of the contraction.

Quite some years ago, following an operation on the heel tendons, a rough callus developed over the site of the scars. He gave thiosinamine by mouth for three months and secured absorption of the scars, the tissue becoming soft like the other skin. Recently in a similar case, he injected fibrolysin in the patient with the same type of result, absorption of the redundant scar and a perfectly normal skin over the top of the old thickened hardened scar.

In a case of congenital Dupuytren's contraction in the fingers in a girl of 13 he used perhaps six injections of fibrolysin, and since then had had the finger on a splint for the purpose of firm extension. The only effect of the fibrolysin observed in this case has been a marked softening of the tissue. It has not now the density which it had before he made the injections, but he was having difficulty in extending the finger because of the contraction of the ligaments on the palmar surface of the joint.

Dr. L. H. Mutschler said that he was called at 5 o'clock in the morning to see a man, about sixty years of age, who had been suffering for a number of months with articular rheumatism. He had had one injection of fibrolysin the afternoon before. He had had a collapse, became short of breath, perspired profusely and everyone thought he was going to die; he seemed to have recovered somewhat by the time he was seen by Dr. Mutschler, being in fairly good shape though still a little delirious. The next day his physician gave him fibrolysin again in half the amount of the first dose, and the patient again became delirious. The last heard of him he had a nurse taking care of him. He had never had any such attack previous to this treatment.

Dr. Emory G. Alexander (in closing) said, with regard to the effects of fibrolysin, there were no bad results in the administration of

the drug in the case of the patient reported, and he had also noticed in the literature that many people recommend giving it intravenously. They claim it produces a nauseating effect sometimes but aside from that he knows of no ill effects at all.

This boy's arm had completely healed when he was again injected a week ago, which has caused the breaking down at the elbow which he exhibits at present.

Dr. A. W. Tucker (by invitation) presented "Some Experiences in Surgical Practice in the Orient."

OBLIQUE SUBTROCHANTERIC FRACTURE OF FEMUR

Dr. Louis H. Mutschler reported this case, not because it is of an unusual nature or of rare occurrence, but to show the excellent results that may be obtained by the open treatment of fractures in contrast to those obtained by the older methods. This woman, 35 years of age, was admitted to the Episcopal Hospital, May 29, 1913.

While attempting to alight from a wagon her skirt caught and she fell to the ground, striking her right hip. She was unable to stand and was brought to the hospital. She was poorly nourished, anæmic in appearance and extremely nervous. She complained of pain in the region of the right hip; the right foot was everted, crepitus and preternatural mobility were felt just below the joint. The right extremity was one and a half inches shorter than the left. A fracture of the upper third of the femur was diagnosed.

Treatment: a Buck's extension with weights was applied and a sand bag placed on each side of the limb. An X-ray picture was taken a few days after admission, and showed an oblique subtrochanteric fracture of the right femur.

The deformity was typical of this kind of a fracture. As is shown in Fig. 1, there was marked displacement; the upper fragment was abducted and tilted forward; the lower fragment was adducted and overlapping the upper fragment to the extent of about one and one-half inches. The line of fracture was oblique from above downward and outward, this being the usual line of direction of fractures in this location.

On June 8 an attempt was made, under chloroform anæsthesia, to reduce the fracture and the limb was again placed between sand bags, in an elevated, abducted position, with twenty pounds of extension.

A second X-ray picture, taken four days later, showed the fragments to be in about the same displaced position. He had considerable difficulty in persuading the patient to consent to an operation. After

several days, however, she decided to undergo an operation and it was done under ether anæsthesia on June 13, fifteen days after the accident.

An incision, about seven inches in length, was made on the outer side of the thigh over the seat of fracture. After exposing and freeing the ends of the fragments from soft tissues he had great difficulty in reducing and holding the fragments in proper position. A Sherman plate with two screws into each fragment held them in place, and, as an extra precaution, he placed a silver wire around the ends of the fragments and over the plate at right angle to the line of fracture. The wound was then closed and a small gauze wick inserted for drainage. The limb was placed between sand bags with light extension.

The wick was removed the third day and the patient made an uneventful recovery. She was permitted to get out of bed after a period of nine weeks and left the hospital walking with the aid of crutches.

Her limb was in good position and each lower extremity measured thirty-five inches when discharged (see Fig. 2). He saw this woman on December 12, 1913, and she was walking about without the aid of crutch or cane. She was attending to her usual housework and went up and down stairs normally. There was no difference in the length of the lower extremities and, with the exception of some slight soreness in the thigh during damp weather, she said she felt perfectly well.

Subtrochanteric fractures of the femur may occur at any age, but are uncommon. Articles describing fractures of the femur, just below the trochanter major and minor, are found among the writings of a hundred years ago. It is interesting to note in this literature how carefully fractures of this nature were studied and described and how accurate are the drawings made from post-mortem specimens. These writers dwell at length upon the marked displacement and resulting deformity and the difficulty encountered in attempts to reduce and maintain the fragments in proper position.

Sir Astley Cooper says: "The thigh-bone is sometimes broken just below the trochanter major and minor; it is a difficult accident to manage and miserable distortion is the consequence if it be ill treated."

To quote Amesbury: "When the fracture is just below the trochanter minor the retraction is sometimes not less than seven or eight inches." This amount of shortening is excessive and probably is seldom seen.

Malgaigne, after fully describing his method of treatment of the type of fracture under consideration, says: "And even with all this, success is very difficult to obtain." The foregoing quotations give a

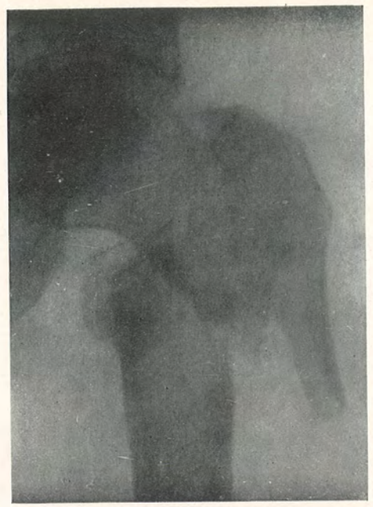


FIG. 1.—Subtrochanteric fracture of femur with displacement.

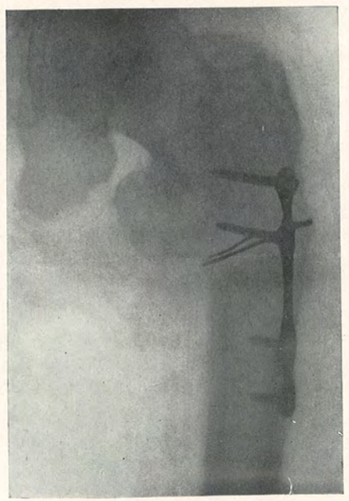


FIG. 2.—Fracture plated and wired.

good idea of the discouragement the early surgeons encountered in treating fractures immediately below the trochanters.

You could not expect, however, these surgeons to obtain better results if the surgeon of to-day, even with the assistance of the X-ray, is usually unable to obtain satisfactory results without resorting to the open treatment. By so recent and able an authority as Scudder we are told that treatment of subtrochanteric fractures by extension and counterextension and the use of the inclined plane are usually ineffective.

The displacement of the upper fragment is due to the action of the iliopsoas and to the rotators fastened to this portion and the retraction and adduction of the lower fragment to the strong muscular contraction of the adductors, probably caused in part by the irritation of the sharp end of the fractured bone. The early treatment of fixation of the pelvis, extension with counterextension, abduction, placing the thigh on an inclined plane, immobilization, etc., has continued with little or no modification up to the present time.

Much has been learned concerning fractures since the discovery of the Röntgen rays. Diagnoses of fracture have been made only to be reversed by the skiagraph. More frequently fractures have not been diagnosed and later have been demonstrated by the X-ray. It is by this means alone that we can positively tell the kind of fracture and the true position of the fragments. It is of the utmost importance, when possible, to have X-ray pictures taken in planes at right angles to each other, otherwise the true deformity is not always shown.

In many cases in which the fragments have united and resulted in good normal function of the part, the skiagraph has revealed the existence of a decided deformity.

The recent interest in and the progress that has been made in what is known as the open treatment of fractures with proper replacement and fixation of the fragments by one of the several methods have been the means of obtaining infinitely better results. The principal objection to the operative treatment is the fear of infection.

If in these days of advanced aseptic surgery we are not reluctant to open the peritoneal or cerebrospinal cavity, why should we hesitate to cut down upon a fractured bone? The X-ray will show the fragments to be in good position in many cases of fracture and obviously no operation is indicated. In those cases, however, with marked and obstinate deformity, like the one under consideration, he believed the open treatment should always be employed, providing the patient's condition permits.

STATED MEETING, HELD APRIL 6, 1914.

Dr. John H. Gibbon, President, in the Chair

SPRENGEL'S DEFORMITY OF THE SHOULDER

Dr. J. Torrance Rugh presented a boy, four years of age, one of a family of four children. The other three were normal. This boy when two years old was noticed to hold the left shoulder higher than the right but, never having complained of any pain, nothing was done until a short time ago. He first came to the Orthopædic Dispensary of the Methodist Hospital in March, 1914, and examination showed an undersized child of rather inferior mentality. The left shoulder was carried nearly an inch higher than the right, the normal curve of the neck on that side was much altered, giving the appearance of a short neck. The scapula was raised and tilted forward and could not be moved up and down. There was inability to raise the arm above the shoulder level or backward as freely as the right, but other movements were normal. Palpation showed a mass anterior and superior to the scapula which moved with the scapula. The posterior-superior angle also appeared fixed, so that scapular movement occurred about this point as a pivot. The spine appeared slightly deviated to the left side in the upper dorsal region, but was not fixed. The chest anteriorly showed prominence of the upper ribs to the right of the sternum, while the left side showed some flattening as in cases of left dorsal rotation of the spine. No other abnormalities were present in the body. A diagnosis of congenital elevation of the scapula (Sprengel's deformity) was made and a röntgenogram was ordered (Fig. 1). This apparently showed a bony formation running from near the coracoid process upward into the neck, which was the mass to be felt by the fingers. It was thought at this time that this bony formation was the cause of the deformity.

Later, operation was performed, on April 28, 1914, at the Methodist Hospital. The bony mass was found to be a hooked scapula (upper border) which lay close to the deep neck muscles and quite high up. This upper edge was removed with forceps but the shoulder could not be brought down for any distance. The posterior-superior angle was then exposed by direct incision, and a distinct articulation was found to exist between that point and the tip of the seventh cervical spine. This latter was greatly elongated and turned to the left side as though it had been pulled over by the scapula. The röntgenogram also shows

Fig. 1.

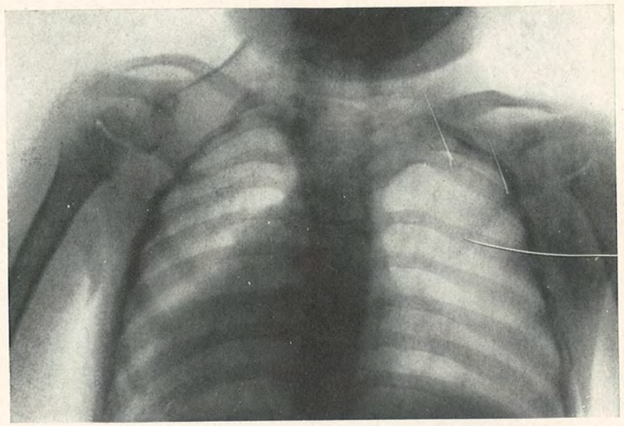
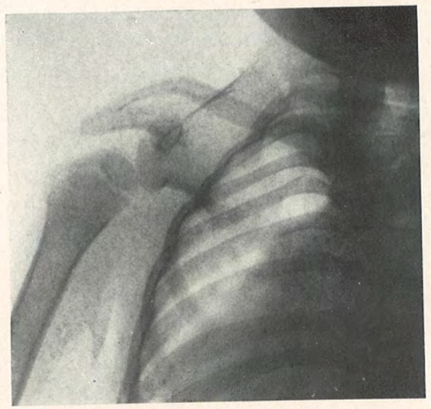


Fig. 2.



Figs. 1 and 2.—Sprengel's deformity of the shoulder.

twisting of the lower part of the cervical spine to the left side and this accounts for the prominence of the anterior right ribs. Three-fourths inch of the spinous process was excised and the scapula freed from attachments. It was then easily pulled down to a level with its fellow. The incisions were closed with catgut and broad straps of adhesive plaster were used to pull the shoulder well down on the chest wall. Recovery was uneventful and a röntgenogram taken showed a quadrangular-shaped scapula lying in practically the same relation as its fellow (Fig. 2).

Dr. Rugh also showed a case of a boy of five years of age who had received repeated injuries to the right shoulder. Marked enlargement of the upper end of the humerus resulted, with more or less limitation of function, but practically no pain. The diagnosis lay between exuberant callus (from possible fracture), a bone cyst and sarcoma, and the opinion of the Fellows of the Academy was asked regarding it. Röntgenograms taken at different periods were also shown.

It was the opinion of the Fellows that the case was one of bone cyst.

Dr. John H. Gibbon, apropos to the Sprengel's deformity case, presented an X-ray plate of a child operated on by him a year ago, in which there was found a narrow band of bone running from the base of the spine of the scapula to the transverse process of a cervical vertebra. This bone was excised. An interesting point in this case is the cleft cervical vertebræ plainly shown in the plate.

Dr. Astley P. C. Ashhurst said that Dr. Gibbon's mention of the cleft cervical vertebræ reminded him of a specimen recently secured from an adult cadaver by a student at the University of Pennsylvania: in this the vertebræ were cleft and there was a bony mass running from the vertebræ over toward the scapula. Evidently no treatment had been required.

Regarding Dr. Rugh's second case he considered it a bone cyst, and that operation is indicated for removal of its contents, and partial obliteration of the cavity by crushing its walls.

RECENT TRAUMATIC DISLOCATIONS OF THE HIP

WITH A REPORT OF TEN CASES AND THEIR END RESULTS

By Carl R. Steinke, M.D.
of Philadelphia, Pa.

During the 9 years from February, 1905, to February, 1914, at the Episcopal Hospital of Philadelphia, 10 cases of recent traumatic dislocation of the hip were admitted out of some 23,000 surgical cases, 6000 of which were classified as surgical injuries, making approximately 1 dislocated hip to every 600 surgical injuries. For the privilege of reporting the following cases I am indebted to Drs. Frazier, Davis, Deaver, Neilson and Mutschler, under whose services they were admitted.

Case I.—M. M., male, age twenty, admitted February 21, 1907 (file No. 619). The patient was admitted with a history of having had a large amount of coal fall upon him. On examination a high posterior dislocation of the left hip was found. The leg was adducted, inverted and flexed. Pain, tenderness and rigidity were noted about the hip. The patient was placed on a table face down, the knee and thigh were flexed and direct traction made downward while an assistant guided the head of the femur by pressure on the great trochanter, thus reducing the luxation (Stimson method). Five days later the patient was discharged in good condition.

Diagnosis.—High posterior luxation of the left hip. At the time this article was prepared no trace of the patient could be found.

Case II.—T. S., male, age fifty (?), admitted October 15, 1907 (file No. 2846). The patient had jumped from a third-story window and was brought to the hospital in an unconscious condition. There was a fracture of the skull and through the middle third of the left femur. The head of the right femur could be felt anterior just below Poupart's ligament. The luxation was easily reduced by circumduction. The next day the pulse became weak and irregular and Cheyne-Stokes respiration was present. The respiration and pulse gradually became weaker and he died on the eighteenth, three days after admission.

Diagnosis.—Fractured skull and left femur, and dislocation (pubic), anterior, of right hip.

Case III.—J. V., male, age forty-five, admitted June 28, 1909 (file No. 1610). He had been thrown from a crane, dislocating his right femur, the head being felt close to the sciatic notch. After reduction sand bags were placed on either side of the affected thigh. On the eleventh day he was up and about with no pain in the hip, so was discharged the next day.

Diagnosis.—Posterior (sciatic) luxation of the right hip. No further history of the patient obtainable.

Case IV.—J. M., male, age fifty-five, admitted April 19, 1910 (file No. 5094). The patient was admitted with a posterior dislocation of the right hip. The right thigh was flexed on the abdomen and adducted, while the knee was flexed and the foot turned in. He was unable to extend the thigh either by force or voluntarily, but could flex it on the abdomen. The great trochanter was felt anterior to its normal position and not prominent. The head of the femur could be felt in the sciatic area and could be felt to rotate with the thigh. Under ether anæsthesia the leg was flexed on the thigh and the thigh on the abdomen in adduction followed by outward circumduction and extension. The head of the femur was felt and heard to snap back into its normal position. Sand bags were placed on either side of the thigh. There was tenderness about the right hip for a week, otherwise he was in good condition. Four weeks later he was up and around, the hip being slightly painful, but he walked about on crutches. He was discharged on the forty-sixth day in good condition.

Diagnosis.—Posterior (sciatic) luxation of right hip. March 23, 1914, four years after the accident, he was working and found no disability from his dislocated hip.

Case V.—B. S., female, age thirty-eight, admitted February 9, 1911, (file No. 473). One week previous to admission, while attempting to cross the railway tracks, the patient was struck by the tender of an engine, the engine and fire box passing over her, causing severe bruises, a fracture through the middle third of the right clavicle and a dislocated hip. The left foot was inverted and rested on the instep of the opposite foot and the head of the left femur could be palpated between the acetabulum and the crest of the ilium. The following day under gas and ether anæsthesia the luxation was reduced by the Allis method. Buck's extension with 10 pounds was applied. Three weeks later the left hip-joint was not particularly painful and showed no tendency of recurrence. The clavicle showed good union with slight deformity. She was discharged in care of the family physician.

Diagnosis.—Posterior (iliac) luxation of left hip.

In a letter from her physician January 24, 1914, three years after the accident, he says concerning her hip condition: "She has disability of the left leg due to the dislocated hip and fractured pelvis, and numbness and loss of power due to nerve injury from deep laceration of the thigh." It would seem her present condition is probably not due so much to the dislocation as to the nerve injury received at the time of the accident.

Case VI.—H. K., male, age twenty-eight, admitted June 7, 1912 (file No. 1834). The patient fell from a 10-foot fence and was immediately brought to the hospital. The left leg was normal. The right leg was flexed and fixed in internal rotation, while the foot lay in inversion and the head of the femur could be felt on the flaring wing of the ilium. There was great pain when the leg was moved and some laxity of the iliotibial band. Under chloroform anæsthesia the luxation was reduced by flexion,

traction, external circumduction and extension. The right leg then measured ¼ inch longer than the left. The next day there was aching pain in the affected hip but he could invert the foot and evert the toes fairly well. On the ninth day the general motion of the hip was fairly free and he was allowed to be about on crutches. Discharged 3 days later, walking on crutches with no limitation of motion and no shortening of the right leg.

Diagnosis.—Posterior (iliac) luxation of right hip. X-ray No. 2527 showed reduction of dislocation. The last of March, 1914, he was reported to be in good health and had a good functional result in his right hip.

Case VII.—B. L. S., male, age sixty-one, admitted January 23, 1913, (file No. 319). In jumping from a third-story window to the ground he caused dislocation of the right hip. The right thigh, well in the position of flexion and internal rotation, could not be brought into full extension. Measuring from the anterior superior spines to the internal malleoli gave 1¼ inches shortening of the right leg. The base of Bryant's triangle on the right was ½ inch shorter than the left. With the right thigh flexed the trochanter was felt 1½ inches above the Roser-Nelaton line. There was an area of tenderness on the level of the anterior superior spine and about 5 inches from it on the right. Reduction by the Stimson method (as in Case I) attempted for 11 minutes. The deformity was improved but the luxation not reduced. The following day the X-ray No. 5243 showed the hip still luxated. The patient being anæsthetized was placed in the supine position on a hard mattress on the floor, and the thigh flexed on the pelvis to a right angle and leg at right angles to the thigh. With traction upward, internal and external rotation of the thigh, together with pressure on the trochanter, the head of the femur was brought into position in the acetabulum. Buck's extension applied with light weights. Two weeks later the patient was in good general condition, and at the end of the third week the weights and straps were removed, making him much more comfortable. Starting at the end of the fourth week he was gradually allowed to remain out of bed for longer intervals and there was no notable deformity of the leg. On the forty-seventh day he was discharged in good condition as cured.

Diagnosis.—Posterior luxation of right hip.

In a letter from the patient just one year after the accident (January 22, 1914), he says: "I run, hunt, climb ladders, skate, and am able to work in the fields of my farm." This is sufficient evidence that he suffers no ill effects from the dislocation.

Case VIII.—W. B., male, age twenty-six, admitted May 8, 1913 (file No. 1803). A cart load of coal was dumped, striking him in the middle of the thigh, covering him with coal, and he had to be lifted on to a stretcher. He complained of pain in the right hip-joint and inability to walk. Examination: The head of the right femur palpated posterior and high up above acetabular rim. The right leg was flexed, inverted and shortened. Ether anæsthesia given and the dislocation reduced by the Allis method. Discharged one week later as cured.

Diagnosis.—High (iliac) posterior dislocation of right femur.

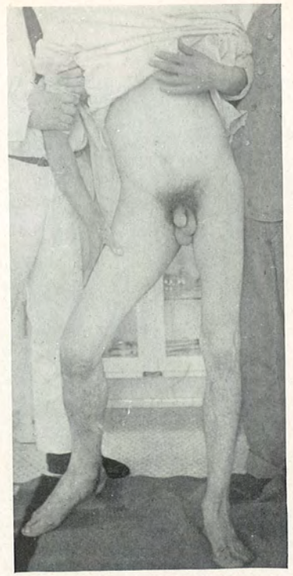


Fig. 1.—Case IX. Showing anterior luxation of right hip.

Fig. 2.—Showing method of reduction (direct) in Case IX.

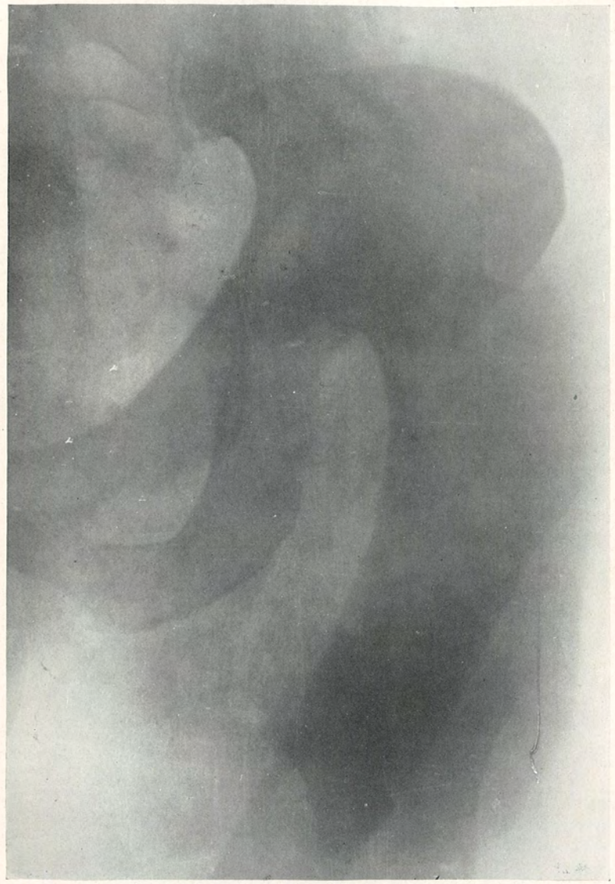


FIG. 3.—Case VII. X-ray No. 5243. Showing dislocation of right hip (posterior).

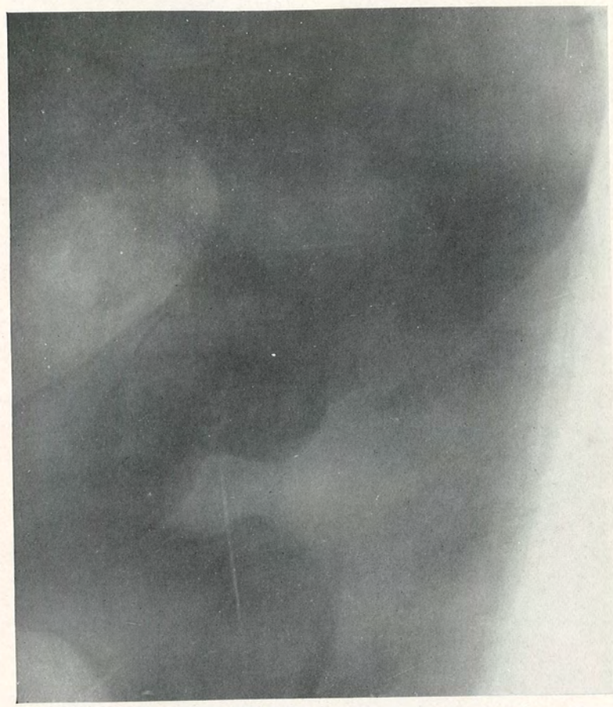


FIG. 4.—Case IX. X-ray No. 8722. Showing anterior dislocation of femur (right).

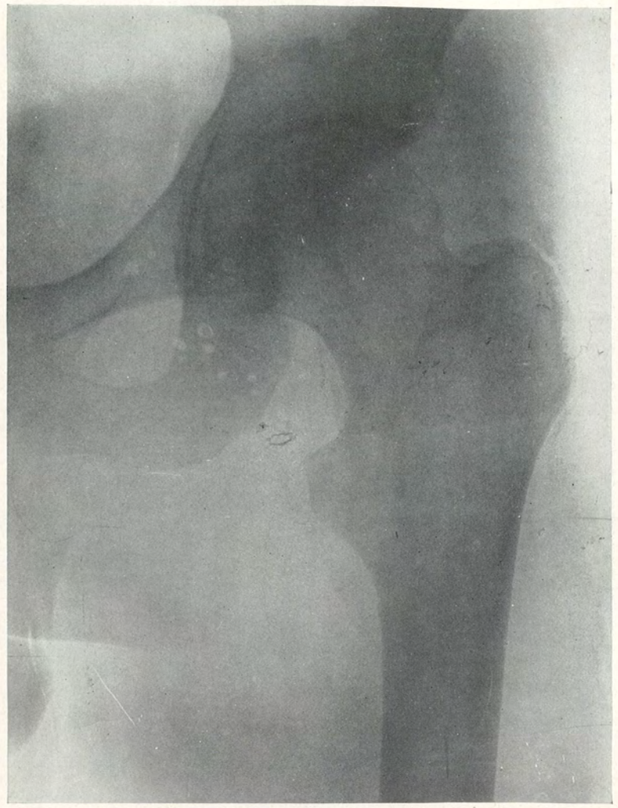


FIG. 5.—Case IX. X-ray No. 257*a*. Showing femoral head in position after reduction.

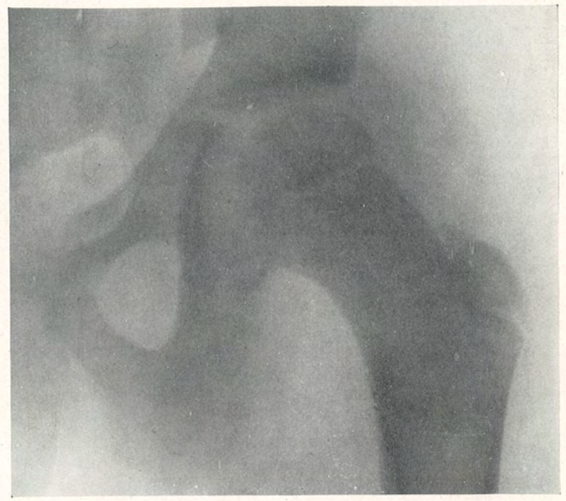


FIG. 6.—Case X. X-ray No. 9437. Showing femoral head in normal position after reduction.

He went to work in three weeks' time. March 21, 1914, ten and a half months after the accident, his hip was in good condition, having no pain at all, and he could go up and down stairs as well as before the accident.

CASE IX.—F. McL., male, age thirty-five, admitted December 8, 1913 (file No. 4974). While working on a roof a heavy gust of wind struck the man, causing him to fall 15 feet. He was brought to the hospital and on examination the left leg was found to be normal. The right leg was flexed, slightly abducted, and appeared lengthened, while the thigh was flexed and could not be straightened. The foot was not everted, probably due to the position of the pelvis. On movement there was severe pain and the head of the femur seemed to be dislocated, but the exact position could not be located, due to the rigidity of the adductors; a large area of ecchymosis was present on the posterior surface of the thigh and there was marked swelling. With the patient standing on the left leg the right was found to be in the position of abduction with the thigh flexed, knee flexed, and the toes resting on the floor in eversion (Fig. 1). X-ray No. 8722 showed an anterior luxation of the right hip. Plate No. 275*a* shows the hip after reduction. The patient was placed on a hard mattress on his back and ether given. An assistant held the pelvis by downward pressure on the anterior superior spines while the right leg was flexed to a right angle on the thigh and the thigh at right angles to the body. By strong traction upward, together with manipulation of the leg producing slight internal and external rotation of the thigh, and at the same time having pressure made on the great trochanter, the femur head was returned to its normal position with a snap that could be both heard and felt (Fig. 2). The patient was then put to bed with sand bags, one on either side of the affected limb. The following day there was still some pain in the hip but the leg was in good position. On the tenth day after reduction the sand bags were removed and the patient allowed to go about on crutches. Two days later he was discharged in good condition, walking on crutches.

Diagnosis.—Anterior (thyroid) dislocation of the right hip. When seen March 23, 1914, he had returned to work and his hip was as good as before.

CASE X.—J. G., male, age ten, admitted January 22, 1914, having been knocked down by an automobile. Being unable to walk he was brought to the hospital where a dislocation of the right hip posteriorly was found. The right leg was short, adducted and everted, the right foot resting on the heel of the left foot. There was limitation of motion of the right hip and the head of the femur was felt posterior to the acetabulum. Ether was given and the luxation reduced by flexion and traction, the head felt to slip into the acetabular cavity. Sand bags were placed on each side of the thigh. X-ray No. 9437 shows the head to be in its normal position after the reduction. On the sixteenth day the sand bags were removed and 2 weeks later he was discharged in good condition.

Diagnosis.—Posterior luxation of the right hip.

When seen March 23, 1914 (2 months after the accident) he was running about playing with the other boys and had no pain or disability.

In the above series of cases there are 9 males and 1 female; the age ranges from 10 to 61 years, and the time in the hospital varies from 3 to 47 days. As to the types of dislocation there were 2 cases of anterior, 1 each of the pubic and thyroid variety, and 8 posterior cases, 4 being iliac or high, 2 sciatic, while 2 are simply given as posterior. This series confirms the statistical records as to the greater frequency of the posterior type.

There were several methods of reduction used and each proved efficient, except in one case when the Stimson method was employed unsuccessfully for eleven minutes. In one case the method was not stated. The indirect method was used once, circumduction twice (although from the description it may have been the indirect with a wide circle of the knee), and the direct 6 times, one of which was accomplished in the Stimson position.

The mode of treatment following the reduction varied. Four cases were simply kept in bed, 2 had Buck's extension applied for a time following the reduction, and the remaining 4 were kept in bed with a sand bag on either side of the affected leg.

At the time this paper was prepared 8 of the cases could be traced; one died of a fractured skull while in the hospital; another was reported as having numbness and loss of power of the leg, due not only to dislocation of the hip but to fracture of the pelvis and nerve injury as well; the remaining 6 cases are reported as being in good health with no disability from the previously dislocated hip, the time since the accident varying from 2 months to 4 years. With such a record it is concluded that simple luxation of the hip when properly reduced should give no impairment of function.

LITERATURE

Stimson: Treatise on Fractures and Dislocations, 7th Ed., 1912, Lea, New York, p. 797.
Cooper, Sir Astley: Treatise on Dislocations and Fractures of Joints, Blanchard and Lea, Philadelphia, 1851, p. 74.
Chace, A.: New York Med. Jour., 1912, xcv, 171–172.
Allis and Roberts: Ann. Surg., Phila, 1911, liv, 371–380; also, Trans. Amer. Surg. Soc., Phila., 1911, xxix, 94.
Davis, G. G.: Applied Anatomy, 2nd Ed., 1913, Lippincott, Phila., pp. 512–513.
Davis: loc. cit.
Stimson: loc. cit., p. 817; also, New York Med. Jour., August 3, 1889.

Dr. P. G. Skillern, Jr., said that before a traumatic luxation can be spoken of, there are two postulates that must be fulfilled. These are that the capsule must be torn and the articular surfaces separated from each other. In the "central luxation of the hip," referred to by

Dr. Steinke, neither of these postulates is fulfilled. The capsule is telescoped, and the articular surfaces usually remain in contact. The correct term to apply to this injury is "perforating fracture of the acetabulum," and if the head of the femur has entered the pelvic cavity, "perforated fracture." The presence of the femoral caput in the pelvis is merely incidental, it being jammed in *after* the fracture of the acetabulum.

Dr. Henry R. Wharton remarked that dislocation of the hip is very rare in children, and he could only recall one case in his experience, which occurred in a child about ten years of age from a heavy body falling upon him, resulting in a posterior dislocation of the hip. A complicated dislocation of the hip was brought to the Presbyterian Hospital; the patient was said to have a dislocation of the hip; attempts at reduction were made but the reduction could not be maintained. Examination revealed posterior dislocation with fracture of posterior lip of the acetabulum. In this case he succeeded in getting reduction and then maintained it by putting the patient up in plaster of Paris, with the thigh abducted, while still under the anæsthetic. The patient made a good recovery.

Dr. Gwilym G. Davis thought that traumatic luxations of the hip are so infrequent that it is a wise thing to record individual cases, particularly as regards the difficulties which are experienced in handling them. One of the cases which was mentioned by the reader, of dorsal luxation, came to the hospital while he happened to be there, and therefore it devolved upon him to look after it; otherwise the resident might have been the only one to have observed it, the chief frequently failing to see luxations, particularly if of the type which is easily reduced. He, therefore, in this case, allowed the house officer to attempt the reduction with the patient on his back, under an anæsthetic. It failed. Then the patient was brought to the end of the bed, which was an iron bed without a footpiece, and allowed the limbs from the hips out to extend beyond the end of the bed. The uninjured limb was held horizontally by one assistant and the other assistant was directed to flex the affected thigh at a right angle to the body and the knee at a right angle to the thigh; the body then was horizontal, the thigh vertical, and the leg horizontal. While one assistant pressed downward on the calf of the leg, a second assistant made pressure on the head and trochanter and it gently sank into its socket. That is the Stimson method and in that case it worked beautifully. Attempts to reduce many luxations are at first unsuccessful on account of the resistance of the muscles; of course this does not apply so much in luxation of the hip where the patient is anæsthetized.

Allis should be given credit for the work which he has done in this line, and particularly for two things; it was he who said that the innominate bone had its anterior and posterior surfaces divided into 2 planes by a line running from the anterior superior spine of the ilium to the tuberosity of the ischium. He also proved the success of the direct method of reducing luxations. His direct method is in the first place to relax all the tissues as far as possible, and then pulling or pushing the head of the bone in the direction of the socket; it is surprising in how many cases this method of reduction will be successful without the employment of great violence.

When it comes to those cases in which difficulty is experienced the most common reason is because the luxation is complicated by fracture. In the present day with the X-ray this point is capable of diagnosis. On one occasion he was present during the attempted reduction of a supposed dislocation by several surgeons; it could not be satisfactorily accomplished and the case was later shown to have had a fracture of the edge of the acetabulum, so that the head would slip out as soon as replaced. When it comes to the shoulder-joint, the fracture will frequently occur close to the joint line and then the fracture and luxation will be confounded and mistaken, one for the other.

Dr. J. Torrance Rugh mentioned the case of a man who had been thrown downstairs. A dislocation of the hip was diagnosed and attempts made at reduction and a great deal of difficulty experienced in reducing it, but finally the head slipped into the acetabulum and the man was put in bed with extension and sand bags. At the end of about three weeks the head had apparently slipped out of the acetabulum. He was again anæsthetized and attempts at reduction were about to be made when suddenly the man became cyanosed and died. Post-mortem examination revealed that the dislocation had been reduced, and that there was a piece broken out of the neck of the femur and a large mass of muscle tissue interposed between this fragment and both ends of the bone from which it was broken, so that no crepitation was present and no fracture had been diagnosed. Death was due to a blood clot which became loosened in the femoral vein.

Some years ago he had a case of thyroid dislocation which was brought down from the coal regions about four or five weeks after the injury; it was supposed to be a fracture, but the X-ray showed it to be a thyroid dislocation and, at that time, reduction by manipulation proved absolutely impossible, so by the open method the head was reduced and a good result secured.

CHRONIC CYSTIC MASTITIS

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It would serve no useful purpose to review in detail the historical data concerning the progress of knowledge concerning chronic cystic mastitis. The attention of surgeons was first directed towards this disease particularly by Koenig, Reclus and Schimmelbush. About a decade ago, Greenough and Warren in this country published the results of their study upon a large series of cases. In this Academy, Speese and Taylor have reported series of cases and have paid particular attention to the relation of carcinoma to chronic cystic mastitis. Additional interest has recently been given to the subject by the publication of a clinical paper by Judd (*Jour. Mich. State Med. Soc.*, 1914, i, p. 11) and one by MacCarty (*Surg., Gynec., and Obst.*, 1913, xvii, p. 441) upon the pathology, both from the Mayo Clinic. It has seemed worth while to the writer to report the results of eighteen cases operated on in Dr. Frazier's clinic in the University Hospital in which the diagnosis of chronic cystic mastitis was made by the pathologist with occasional reference to the occurrence of epithelial hyperplasia. I have excluded those cases diagnosed as chronic cystic mastitis and carcinoma; they have been included with the cancers, and the early cases were reported to this Academy in 1909 by Dr. Speese (Annals of Surgery, 1910, li, 213).

It is not necessary to discuss the changes occurring in the normal breast at the time of involution, nor is it necessary to dilate upon the fact that this disease is believed to be due to certain abnormal changes occurring at this time.

The term chronic cystic mastitis is open to certain objections and that this has been realized by various writers is evident by the fact that there are twelve synonyms for the disease, no one of which seems perfectly satisfactory.

When examined grossly these breasts show an increase in the fibrous tissue generally throughout the entire gland, but more dense in certain areas or about certain lobules. It varies from white to gray in color and in many cases is of cicatricial consistency. Cysts are present in every case, occasionally in microscopic dimension only, but as a rule varying in size from a few millimetres up to several centimetres. They contain fluid varying in color from clear watery fluid through all shades

of yellow and green up to black. Histologically, the fibrous tissue is found increased, especially that derived from the interlobular connective tissue; a round-cell infiltration is frequently observed; the large ducts are occasionally compressed; the acini in the lobules vary considerably in size and their lining epithelium shows various stages of proliferation. It is this variation in the epithelium which has given rise to much discussion and which at times suggests or indicates the histologic picture of cancer. To discuss the matter in the language of Greenough or of Warren we see two types of the disease, those in which the changes are distinctly cystic with flattened, atrophic epithelium and those in which proliferation is a characteristic feature with varying degrees of hyperplasia of the epithelium, even to the formation of adenomatous areas. MacCarty calls attention to the fact that the secretory cells of the primary acinus, composed of one row of columnar or cuboidal cells, rests upon another row of cells almost invisible in the normal breast but prominent when there is a chronic inflammatory reactive process present, and which corresponds to the so-called *stratum germinativum* of the skin and constituting the germinal cells of the epithelium of the breast. These will be referred to as the outer cells and the first mentioned as the inner cells. When both are present he terms the histologic picture a primary epithelial hyperplasia; the inner cells disappear and there remain only the hyperplastic cells of the outer row. This condition will be referred to as secondary epithelial hyperplasia, and he states that it may be frequently seen in chronic cystic mastitis and may or may not be malignant. When the cells of the outer row appear in the periacinal stroma, the condition may be spoken of as tertiary or migratory hyperplasia and is, of course, carcinoma. MacCarty believes that we should determine the percentage of cases of secondary hyperplasia which will remain well or will recur after the removal of the primary gland itself without the removal of the lymphatic gland, muscles and large amounts of skin.

I have examined the slides of 14 of our cases for the purpose of classifying them according to the MacCarty scheme. In nine the hyperplasia was of the primary type, *i.e.*, the growth was benign. In the tenth case the patient was operated on three times, twice in the left and once in the right breast, and in all three neoplasms primary hyperplasia only was found. In the eleventh case the mass in the left breast was excised subcutaneously and revealed the secondary type of hyperplasia, while a growth in the right breast removed two years later was of the primary type. In another case the right breast was removed in 1904 and showed primary hyperplasia. Six years later a mass was

removed from high in the upper outer quadrant, the remains of the breast, and showed a secondary hyperplasia. In two other cases the secondary type of hyperplasia was encountered. Of the four secondary hyperplasias, *i.e.*, the type which may or may not be carcinomatous according to MacCarty, three of the patients were traced and reported cured five years, four years, and three years, respectively, after operation. Of the ten primary hyperplasias, eight have been traced and all reported cured. The tertiary hyperplasias or carcinomas are not reported because we include them under the cancers.

While this series is entirely too small to draw important deductions, it is interesting to note that the average age at operation of the patients with primary hyperplasias was thirty-six; of the secondary hyperplasias, forty-one.

The clinical features of this disease are well known by most surgeons, although it has been my experience that most men in general practice have rather vague ideas upon the subject, and this cannot be wondered at considering the confused nomenclature and varied descriptions of the pathology. The malady affects the breasts of women at an average age of forty years, may involve one or occasionally both breasts, is associated with a certain amount of pain, occasionally referred down the arm, and upon examination a rather vague mass is felt, containing one or more hard nodules, and which is not adherent to the skin or to the underlying pectoral fascia. Examination of the axilla rarely reveals any enlargement of the nodes there. In Judd's recent paper he reports 218 cases of chronic cystic mastitis, eleven occurring in males, of which 85 per cent. occurred during the "cancer age" (30 to 60 years). The greater number of cases gave a history of having had previous mastitis and nearly all of them complained of pain. In our series pain was the exception rather than the rule, and 89 per cent. were between 30 and 60 years.

TABLE I

AGE INCIDENCE

	Cases
Between 10 years and 20 years	1
Between 20 years and 30 years	2
Between 30 years and 40 years	5
Between 40 years and 50 years	9
Between 50 years and 60 years	1

The youngest, fifteen years (male); the oldest, fifty years. Average age, thirty-eight years, eight months. Married, fifteen; single, two; male, one. Ten had borne children; four were childless. The menstrual history was of no importance in any case.

In the family history the occurrence of cancer was noted in five instances, tuberculosis twice, and in one of these both tuberculosis and carcinoma were present in the family history. Only two patients of the eighteen stated that they had injured the breast and both ascribed the mass to the injury. In only one case was there a previous history of acute mastitis and in this patient there was also a history of trauma. Four of the patients, at least, were ptotic.

The duration of the disease was very variable and any statements on this point would be inaccurate because often the patient would state that the "lump" had been present for a few weeks or months when it probably had existed for a longer period. One patient had only noticed the mass for three days and immediately came for operation. Another had noted the mass for five years and still another stated that she had had masses in the breasts ever since she was a little girl.

Of these 18 patients a definite, satisfactory letter has been received from 15, and in all of them cure has evidently occurred. The period of cure varies from eight months to nine years and seven months and may be tabulated as follows:

TABLE II

INCIDENCE OF CURE

	Cases
Eight months to three years	4
Three years to six years	5
Six years to ten years	6
Not traced	3

Treatment.—In discussing the treatment of chronic cystic mastitis we are confronted by the statistics of 295 cases collected by Speese (ANNALS OF SURGERY, 1910, li, 213) in which the diagnosis of cystic mastitis was made and the subsequent pathological examination revealed carcinoma in 15 per cent. In 1910 Dr. Taylor (ANNALS OF SURGERY, 1910, lii, p. 253) reported before this Academy 26 cases in which the diagnosis of chronic cystic mastitis had been made of which 50 per cent. showed carcinomatous degeneration. We are also confronted with the statement from the Johns Hopkins Clinic that if we remove a mass from the breast which upon microscopic examination turns out to be carcinoma, the patient will almost inevitably die within the three-year limit even though the secondary complete operation is performed a few days later. On the other hand, Judd from his experience with 218 cases reports that in 211 a conservative operation was performed and in none of the cases was there found evidence of malignant degeneration. In the remaining seven cases of doubtful malignancy the radical operation was performed. It is not stated in his report whether this

examination was made from frozen section at the time of operation or whether it was made later, but both Judd and MacCarty state that in the experience of the Mayo Clinic the removal of the mammary gland preceding an immediate radical operation has not been associated with earlier recurrence than has been found after a primary radical operation. In the discussion (ANNALS OF SURGERY, 1910, lii, 253) before this Academy in 1910, Dr. Taylor stated that, as a rule, he would remove the whole gland in a case of carcinoma except that the muscle is allowed to remain unless the tissues of the breast appear macroscopically uncertain. Gibbon would practise complete removal only when the disease had existed for a long time, where there were multiple cysts or where there was recurrence, after operation. Ross removed the gland subcutaneously and Rodman was partial to Warren's operation if there were a competent pathologist at hand to make a frozen section report. The plan of treatment recently suggested by MacCarty deserves consideration. He believes that in the doubtful cases in women near or over thirty-six years of age, they should have the entire mammary gland removed for immediate examination. If primary or secondary hyperplasia be present nothing more should be done; if tertiary hyperplasia be present a radical operation should be performed. In doubtful patients near or under thirty-five years of age a wide section of the gland should be removed, and if primary hyperplasia be present nothing more should be done; if secondary hyperplasia be present the remainder of the gland should be removed, and if tertiary hyperplasia be present the radical operation should be performed. Judd slightly varies this procedure and advises, in women under twenty-seven years of age, partial excision preferably by the Warren method; in those between thirty and forty years he believes that the radical operation is the surest method but prefers for cosmetic reasons to practise partial excision and to abide by the decision of the pathologist, doing a radical operation at the time if necessary. In patients between the ages of forty and sixty a radical operation should be performed but the muscle need not be removed in definite benign conditions.

In our own series of cases, resection of a portion of the gland was performed seven times; in one of these the breast was completely amputated and the axilla dissected out because of apparent recurrence two months later and we were fearful of carcinoma; no microscopic evidence of carcinoma, however, was found in either specimen, but unfortunately the patient has not been traced. In a second case the resection was followed two and a half years later by a subcutaneous excision of the entire breast for apparent recurrence. This patient

returned a little later for a similar condition in the opposite breast which was also excised subcutaneously. She reports herself at the present time as being entirely well, and, curiously, on January 31, 1914, gave birth to a daughter, at which time the tissues over the chest were tender and there was a slight discharge from the nipple. Excision of the breast was performed in the remaining eleven cases, in one being accompanied by a dissection of the axilla, and in another a radical operation was done two years after the excision. Both these cases have been traced and are perfectly well. One patient who had both breasts operated on with a complete amputation on one side and a subcutaneous excision on the other much prefers the former operation, stating that the remaining nipple is quite tender.

I have called particular attention to these recent statements of Judd and MacCarty, because every one is familiar with the older literature and perhaps even the new does not offer anything in the way of progress. There have been a number of papers written upon malignant degeneration or carcinomatous changes in chronic cystic mastitis and Judd makes the statement that chronic cystic mastitis is a precancerous condition. No one has ever seen the direct transformation, however, and it is only by tracing the border-line cases, the secondary hyperplasias of MacCarty, that we are able to determine in just what cases a radical operation should be done and in which cases a conservative one performed. There is no reason why chronic cystic mastitis could not be produced by the pressure of the carcinoma cells together with the fibrous hyperplasia that always accompanied this disease, and therefore a result, not a cause, of the cancer. It may be coincident.

The two diseases are closely interwoven, however, and any tendency to conservative treatment in women over thirty years of age is to be deprecated.

In conclusion I wish to express my indebtedness to Dr. Frazier for permitting me to collect and report his cases as well as for the privilege of using his wards for my own patients and in some instances for operating on his patients. I have had six patients suffering from chronic cystic mastitis operated on in other hospitals and Dr. Frazier has had a number of cases in the Episcopal Hospital, but we have thought it best only to report the series in the University Hospital.

Dr. Charles H. Frazier said that Dr. Müller and he had been going over the results of this series, during the past year, and they had come to the conclusion, that in the future they would adopt the radical method rather than the conservation operation, that is, the complete removal

and not the partial resection of the breast. He did not believe there will be much dissent on the part of surgeons as to the adoption of this general principle, though there may be some dispute as to whether the breast is removed subcutaneously with conservation of the nipple, or whether the breast together with the nipple is removed through an oval incision. As a matter of convenience the latter procedure will be preferred and may be in many respects the most satisfactory. As a general principle, the surgeon inclines to the operation which involves the least mutilation, and he had always thought, particularly where the breast on the other side was not very large, that the patient would be better satisfied if the nipple was not removed. For this reason in many of his cases the nipple has not been removed and a subcutaneous purse-string suture is introduced to prevent the nipple flattening out and becoming adherent to the chest wall. But in this connection it is interesting to hear that the patient who had the nipple conserved on one side and removed on the other preferred the latter procedure. While as a matter of routine frozen sections are made at the time of operation, the limited time afforded for the examination and the limited area of tissue investigated has led him to place little reliance upon the pathologist's report from the frozen section. If upon further study carcinoma is discovered, a secondary operation is performed for the removal of the pectoralis major and the other steps incident to a radical operation.

Dr. J. S. Rodman said that during the last five years he had seen a good many of these cases of chronic cystic mastitis, perhaps between 50 and 60. The recent paper by McCarty is exceedingly interesting from the pathological stand-point; its chief importance is perhaps to correlate the clinical results with laboratory findings as has been pointed out. In the series of cases which the speaker had seen at his father's clinic the majority of those presenting small shot-like cysts with inky black fluid proved to be the ones that were the most prone to undergo malignant change. There have been 6 instances of double cystic mastitis where operation first on one side was done, the patient returning later for operation on the other gland.

There are one or two little points of interest in the diagnosis of this disease. The superficial veins of the breast are rather apt to be prominent, and there is apt to be considerable pain at various times, particularly at the menstrual periods, at which time the patient also complains that the breast appears to be larger than at other times. As to the treatment of chronic cystic mastitis, his father was now of the opinion that the best operation, particularly in women of the cancer age, is to do the complete operation for cancer. He feels that removal of the

muscle makes so little difference to the patient that it should always be done. On the other hand, in very young women it is worth while to take a chance with the less complete operation, the resection being according to the plastic plan of Warren. As to the frozen section, they always use it and had come to depend a good deal on it, in spite of the fact that in three instances which he could recall the frozen section has been wrong. If the diagnosis of general cystic mastitis is returned, the gland is sacrificed, provided the woman is over thirty-five years of age.

Dr. George P. Müller (in closing) said that the 18 cases reported by him were diagnosed in the laboratory as chronic cystic mastitis and not as carcinoma with chronic cystic mastitis. They have had 40 or 50 cases during these 10 years which were diagnosed clinically as chronic cystic mastitis but in which the laboratory examination revealed carcinoma. These are filed under the cancers. In none of the cases traced has there been any development of cancer; there has been a recurrence of cystic nodules when partial resection had been done and some of these required a second operation. One cannot say in all cases of chronic cystic mastitis from the clinical examination alone whether carcinoma is or is not present. It can only be done by the most careful microscopic examination. Last year Syms reported, before the New York Academy of Surgery, a case operated on for chronic cystis mastitis but in which later examinations revealed carcinoma; Hartwell and Lee reported similar cases. For this reason he believed that complete amputation of the breast and a dissection of the axilla is indicated in all women over thirty years of age; in acute appendicitis we know that most of the patients will get over the attack under non-surgical treatment but we never know in the individual case before us whether he will get well or progress to gangrene, etc. It is so in chronic cystic mastitis; we do not know whether the breast contains cancer or not. He also wished to refer to the frequent criticisms of the laboratory diagnosis by surgeons of little pathologic experience. Microscopic diagnosis is not any more exact than a clinical diagnosis. It is a matter, to some extent, of personal equation or of the experience of the examiner, and while the pathologist makes less mistakes than the clinician, yet he is more frequently criticised than the latter.

INDICATIONS FOR AND VARIATIONS IN THE TECHNIC OF ECK FISTULA

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The production of an artificial communication between the vena cava and portal vein for the relief of certain pathological conditions was first described by Eck in 1877 and therefore bears his name. He suggested the operation especially as a remedial measure in cases of cirrhosis of the liver with abdominal ascites. He never attempted the operation on man, however, as his mortality with animals was rather high. Numerous technics have since been elaborated, several of which are quite uniformly successful. Probably the best known of these is the one described by Carrel and Guthrie, which with slight modifications has been used in all our experimental work.

The operation has been performed twice on man. The first was by Vidal in France, the report of which he published in *La Semaine Medicale* in 1903. The patient had cirrhosis of the liver, and was apparently benefited by the operation, but died four months later from an "endovascular infection of enteric origin."

The second operation was performed by P. Rosenstein, who reports it in the *Zentralblatt für Chirurgie,* Leipsic, February 28, 1914. His case also had cirrhosis of the liver with marked ascites, necessitating frequent tappings. He first tried omentopexy, but without gaining any relief. He next performed an Eck fistula operation which he says only gave temporary relief, tappings having to be resumed a short time after. He next tried drainage into the urinary bladder through a valvular opening. This, he reported, gave almost complete relief. He does not describe his technic for the Eck fistula and it is very possible that the portal pressure was not sufficient to keep the anastomotic opening patent. We have observed this in dogs when the portal was not ligated above the anastomosis. It is also possible that the communication between the portal and vena cava was not sufficiently large. In one of our dogs this mistake occurred and when the animal was killed about three months afterwards, a marked dilatation of the vessels in the entire portal system with compensatory circulation was found, although the anastomosis was still patent. The opening practically always contracts to a certain extent and in his case, while it appeared sufficient at first, may have contracted below the physiological limit for adequate

functioning. We have also observed this in our experimental animals. Several surgeons, especially in this country and in Italy, have opened the abdomen with the expectation of performing an Eck fistula, only to find the adhesions so dense around the hilus of the liver and the portal vein and vena cava that the operation could not be performed. Dr. Frazier and I recently opened an abdomen with the object of performing an Eck fistula, but the adhesions throughout the entire abdomen were so extensive that it was impossible to reach any of the larger veins.

Experimental work on dogs and cats has amply proved the procedure feasible, and that comparatively little danger exists in the operation itself. The animals remain healthy, usually gain in weight as normal animals should, and at least when on a normal mixed diet show no toxic symptoms whatever.

Indications for Eck Fistula.—Cirrhosis of the liver with ascites, for which condition the operation was first devised, still offers the principal field for its employment. Those cases with an alcoholic history and without serious changes in other organs are probably the most favorable for this procedure. In those cases in which an attempt at compensatory circulation exists, shown by the so-called "caput medusæ" and by enlargement of the œsophageal and hemorrhoidal veins the operation is particularly indicated, since the greatly enlarged veins, particularly in the œsophagus, are prone to rupture at any time. This is so often fatal that indications for its relief completely overshadow those for the simple improvement in the ascites. The operation of Eck's fistula offers, at least theoretically, the most promising relief for the impending œsophageal hemorrhage, in fact offers the only immediate relief from danger. But it would be much better to operate in the early stages, when ascites is the only complaint, than to wait for the most serious of the sequelæ.

The Talma-Morison operation of epiplopexy or omentopexy offers in the early stages of hepatic cirrhosis a simple method for the relief of ascites and in many cases has afforded marked improvement, some even claiming a cure of the ascitic condition. It is certainly a question in the early stages, which operation, epiplopexy or Eck's fistula, should be the choice. The mortality from the former has been very high, but principally, I think, because it was performed too late in the disease, considerable shock resulting from the extensive irritation of the peritoneum. The mortality from the Eck fistula operation should be small, especially if done early, as there is actually very little trauma to the peritoneum. The two cases in which it was performed suffered no ill

effects from the procedure. Omentopexy affords very little relief in the late stages when the œsophageal varices have formed, so that in this condition we can offer little hope except by an artificial, direct anastomosis between the portal and caval systems.

Cirrhosis due to stasis in the hepatic veins, so-called nutmeg liver, the liver of chronic congestion, is often associated with ascites, but in this case neither omentopexy nor Eck fistula could be expected to afford relief since the trouble lies, not in the portal, but in the vena cava itself. The pressure in the latter is so high that stasis occurs in all its tributaries, and the flow through the portal is more or less dammed back. These cases are usually associated with marked valvular lesions in the heart and no surgical procedure except drainage of the ascites can be offered.

In Banti's disease we apparently have a primary splenomegaly with a secondary cirrhosis of the liver. In this condition Eck fistula should give complete relief from the portal obstruction and resulting ascites. A fourth class of patients which could be materially helped by Eck fistula are those suffering from thrombophlebitis of the portal vein. The etiology of this condition varies considerably, but probably most cases are due to syphilis and to primary or secondary cryptogenic pyogenic infections. The vein shows a phlebosclerosis upon which thrombi form, more or less occluding the lumen. Occasionally complete obstruction occurs and unless canalization soon takes place the portal obstruction proves fatal. The splenic veins are also involved in many of these cases. Indeed, Warthin considers this the primary factor in the etiology of Banti's disease. Obviously, the classical Eck fistula operation could not be done in these cases, since the portal may be more or less diseased for the greater part of its length. In this class of cases we would make the anastomosis between one of the larger mesenteric veins and the vena cava or if more convenient on one of the common iliacs. Certainly omentopexy in this condition could not be expected to give the relief which a modified Eck fistula would afford.

Those cases of ascites due to nephritis or serious cardiac lesions would not be benefited by either omentopexy or Eck fistula, repeated tappings or drainage into the parietal tissues being the only surgical measure advisable.

Technic of Eck's Fistula.—A simple method for lateral venous anastomosis which did not involve an exposure of the opened vessels was described by Sweet in 1904. In his method a posterior row of sutures approximating the portal and vena cava is laid, similar to the posterior row in a gastro-enterostomy. Two needles bearing a fine

platinum wire are then passed through the lumen of the vessels from above downwards, the position of the wire determining the location and size of the anastomotic opening. The anterior layer of sutures is then placed, completely closing, except at the lower end where the wire emerges, the space through which the anastomosis will be made. The wire is then connected to a special holder and an electric current passed through it. Careful traction is now made, and the wire, acting as a cautery, rapidly cuts a communication between the two veins. When the wire emerges at the lower opening a very little blood escapes, which is immediately controlled by tying the last suture. This effectually closes the lower opening.

Bernheim in 1912 published a technic quite similar. Instead of employing the electric cautery he used a special type of scissors armed with a guard. Previous workers, including Eck and Pawlow, have used practically the same method, with the exception of the guard on the scissors. Bernheim claims that with these special guarded scissors it is impossible to injure the outer walls of either vein, and the size of the cut can be made with mathematical exactness.

It is interesting, when we consider that in this operation no attempt, other than the exclusion of the air, is made to prevent clotting, that no thrombus occurs. The volume and rapidity of the blood stream seem to be sufficient to prevent any accumulation of erythrocytes upon the thin layer of fibrin which always forms on the cut edges. This is one factor strongly in favor of the operation on man, since it minimizes the greatest danger of the operation, that of thrombosis.

The operation as described by Carrel and Guthrie is essentially as follows. The vena cava and portal vein are isolated, their lumens closed above and below the site of anastomosis by ordinary serrafins, spring-jawed clamps or tape, and an incision made in each vessel, parallel with its longitudinal axis. Guthrie states that "the openings in the vessels should be in width about one-third the diameter of the vessel, and in length about one and one-half times the diameter of the vessel." But it is usually not necessary to actually cut away any of the vessel wall, the natural contraction of the circular fibres after the longitudinal incision allowing sufficient width. It is, however, essential that the openings in the corresponding veins should be the same size and shape, else considerable difficulty will be experienced in their proper approximation. The isolated portion of each vessel is thoroughly washed out with liquid vaseline. Two stay sutures are then placed, one at each end of the oval openings, so that the vessels are accurately approximated, the knot of the suture being outside in the

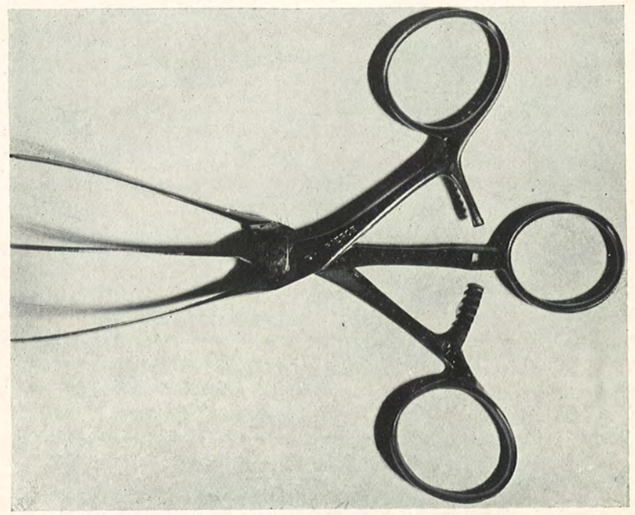

FIG. 1.—Author's three-bladed, spring-jawed blood-vessel clamp, opened.

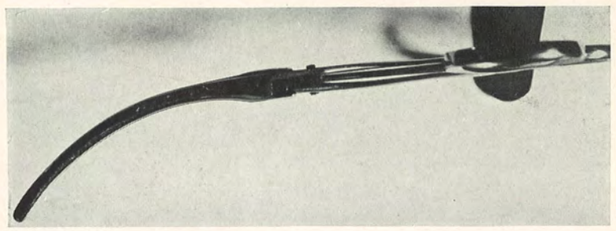

FIG. 2.—Showing curve of blades.

angle formed by the two vessels. A third suture may be placed through the two posterior walls for traction, but should not be tied. One of the stay sutures then re-enters the vessel through its wall and a continuous over-hand suture joins the posterior edges. It is then passed through the vessel wall and tied with the second stay suture. The anterior wall is closed in a like manner. Very fine straight needles with ooo silk are used, and the stitches should be placed about one-half millimetre from the cut edge and about one-half to one millimetre apart.

The modifications in this technic which we adopted consisted only in the manner of procuring temporary hæmostasis and in the type of needle used. To do away with the time-consuming isolation of the vessels which consisted in freeing them for the entire length of the clamped-off portion, the clamping or tying of their tributaries and the application of the four serrafins, we used, after the first few operations, a pair of curved spring-jawed forceps designed by Dr. Sweet. These are practically diminutive intestinal clamps. It was found advisable to cover the blades with gauze or cotton cloth to prevent their slipping from the veins. These forceps are easily and quickly applied by simply raising the vessel with the fingers and clamping it lengthwise, the curve of the blades and their length giving ample room for the incision. Since difficulty was sometimes experienced in maintaining the parallel position of the two clamps I had a three-bladed clamp made which resembles the ordinary gastro-enterostomy clamp except in size. The application of this clamp is very simple. The portal and vena cava are lifted with the fingers and caught between their respective blades. We have found this clamp perfectly satisfactory in animal work.

The other modification of Carrel's technic was in the use of curved needles instead of straight. We had the Kirby No. 16 needles shortened by about half and curved. The sutures could thus be much more easily placed, especially near the ends of the opening.

The variation in the above technic necessitated by different pathological conditions consists only in the choice of vessels used. When the portal is thrombosed or otherwise diseased, or when adhesions prevent access to the upper vena cava, it will be found perfectly possible to make the anastomosis elsewhere. Normally, in the human a large mesenteric vein is found lying just above the common iliacs. If the mesenteric vein is not of sufficient length to be easily approximated to the iliac the former may be ligated near the mesenteric base, divided, and turned downward. We have performed this modification on the dog and found it satisfactory. In the same way the mesenteric vein could be anastomosed to the lower vena cava. If an operator should

fear to use the iliac, I think it would be possible to bring up the saphenous vein, as is sometimes done for drainage of ascites, and anastomose the mesenteric vein to it.

Conclusions.—From a rather extensive use of the Eck fistula in dogs we consider the operation safe, entirely compatible with a normal life, and simple of execution. We prefer the modification of Carrel's technic.

In cases of liver cirrhosis with ascites and in cases of thrombosis or other obstruction to the portal circulation, we consider the operation advisable, especially so where œsophageal varices exist. In the latter condition, at least, it should prove much superior to omentopexy.

BIBLIOGRAPHY

1877. N. V. Eck: Militär-medicinisches Journal, 1877, cxxx, Jahrgang, 55.

1879. N. V. Eck: Also in Travaux de la Soc. des Naturalistes de St. Petersburg (Bulletins de la Section Zoologique), 1879, x.

1882. Stolnikow: "Die Stelle vv. hepaticarum im Leber- und gesammten Kreislaufe." Pflüger's Archiv. für die gesammte Physiologie, 1882, xxviii, 255.

1892. Hahn, Massen, Nencki, et Pawlow: "La fistule d'Eck de la veine cave inferieure et de la veine porte et ses consequences pour l'organisme." 1. Partie physiologique, par MM. Massen et Pawlow. 2. Partie chimique, par MM. Hahn et Nencki. Archives des sciences biologiques de St. Petersburg, 1892, i, 401.

1893. Hahn, Massen, Nencki, et Pawlow: Also in "Die Eck'sche Fistel zwischen der unteren Hohlvene und der Pfortader und ihre Folgen für den Organismus." Archives f. exp. Path. u. Pharm., 1893, xxxii, 161.

1893. Pawlow, J. P.: "Sur une modification dans l'operation de la fistule d'Eck entre la veine porte et la veine cave inferieure." Archives des sciences biologiques de St. Petersburg, 1893, ii, 581.

1893. Kotliar: "Contribution à l'étude du role du foie comme organe defensif contre les substances toxiques." Archives des sciences biologiques de St. Petersburg, 1893, ii, 587.

1894. Markuse: "Über die Bedeutung der Leber für das Zustandekommen des Pankreasdiabetes." Zeitschrift für klin. Med., 1894, xxvi, 225.

1895. Querolo: "Ueber die Function der Leber als Schutz gegen Intoxication vom Darm aus." Moleschott's Untersuchungen zur Naturlehre des Menschen und der Thiere, 1895, xv, 228.

1895. Nencki: Footnote in regard to the method of Querolo, in Maly's Jahresbericht über die Fortschritte der Thierchemie, 1895, xxv, 310.

1895. Hédon et Delezenne: "Effets des injections intraveineuses de peptone après exstirpation du foie combiné à la fistule d'Eck. Compt. rend. de la Soc. de Biol., 1895, xlviii, 633.

1895. Montuori: "Sull'importenzo del fegato nel diabete pancreatico." Gazz. d. Osped. ed. clin., 1895, No. 10.

1896. Magnamini: "La modificazioni del ricambio azotato dopo l'innesto della vena porto colla vena cava inferiore." Il. Policlinico, 1896, iii, 153.

1896. Magnamini: "Les modifications de l'échange azoté après qu'on a mis la veine porte en communication avec la veine cave inferieure." Arch. ital. de biologie, 1896, xxvi, 66.

1896. Schupfer: "Sugli effete che induce mell' organismo l'innesto della vena porta nella vena cava inferiore per rispetto all' autointossicazioni di origine intestinale." Il. Policlinico, 1896, iii, 357.

1896. de Filippi: "Nota sul ricambio materiale dei cani operati di fistula Eck." Riforma med., 1896, xii (vol. iv), 243.

1896. Nencki, Pawlow et Zaleski: "Sur la richesse du sang et des organes en ammoniaque et sur la formation de l'urée chez les mammifères." Archives des sciences biologiques de St. Petersburg, 1896, iv, 191.

1897. Nencki und Pawlow: "Zur Frage über den Ort der Harnstoffbildung dei den Säugethieren." Archiv. f. exp. Path. u. Pharm., 1897, xxxviii, 215.

1897–1898. L. Popielski: "Ueber das Schicksal des Zuckers bei Hunden mit Eck'scher Fistal." Bolnitschnaja gaseta Botkina, 1897, No. 46. Also St. Petersburg med. Wchnschr., 1898, xxiii, 2.

1898. Nencki, Pawlow und Zaleski: "Ueber das Ammoniakgehalt des Blutes und der Organe und die Harnstoffbildung dei den Säugethieren." Archiv. f. exp. Path. u. Pharm., 1898, xxxvii, 26.

1898. Doyon and Dufourt: "Effets de la ligature de l'arterie hepatique et de celle de la veine porte." Arch. de physiol. norm. et path., x, pp. 522–37, 1898.

1898. Salaskin, S.: "Ueber das Ammoniak in physiol. und patholog. Hinsicht und die Rolle der Leber im Stoffwechsel stickstoffhaltiger Substanzen." Zeitschrift für physiologische Chemie, 1898, xxv, 449.

1898. Salaskin, S.: "Ueber die Bildung von Harnstoff in der Leber der Säugethiere aus Amidosäuren der Fettreihe." Ibid., p. 128.

1898. Bozzi: "Alterazioni anatomopatologiche nei cani operati di fistola di Eck." Bologna, 1898.

1899. v. Karltreu: Demonstration und Mittheilung über die Vereinigung der unteren Hohlvene mit der Pfortader (Eck'sche Fistel). Wiener klin. Wochenschrift, 1899, xii, 205.

1899. de Filippi: "Recherches sur l'echange material des chiens operes de fistule d'Eck. Contribution a l'etude de la physio-pathologie du foie." Archives ital. de biologie, 1899, xxxi, 211.

1900. Salaskin und Zaleski: "Ueber den Einfluss der Leberexstirpation auf den Stoffwechsel bei Hunden." Zeitschrift für physiologische Chemie, 1900, xxix, 516.

1900. Bozzi: "Richerche sperimentali dirette a studiare i rapporti possibili fra intestino, fegato e reni." Firenze, 1900.

1901. Nencki and Zaleski: Zeitschrift f. physiol. Chem., xxx, p. 193, 1901.

1901. v. Karltreu: "Ueber die Vereinigung der unteren Hohlvene mit der Pfortader." Arch. f. exp. Path. u. Pharm., 1901, xlv, 56.

1901. Strauss: "Zur Funktions Prüfung der Leber." Deutsche med. Wochenschr., 1901, 757, 786.

1902. Tansini: "Ableitung des portalen Blutes durch directe Verbindung der V. portae mit der V. Cavae. Neues operatives Verfahren." Centralblatt für Chirurgie, 1902, xxix, 937.

1902. Biedl and Winterberg: Beiträge zur Lehre von der Ammoniak-entgiftenden Function der Leber." Arch. f. d. ges. Physiol., lxxxviii, 1902, p. 140.
1903. Schulz and Müller: "Klinische, physiologische und pathologische-anatomische Untersuchungen um einen Fall von hochigradigen Ascites bei Pfortaderthrombose." Deutsches Arch. f. klin. Med., 1903, lxxxvi, 544.
1903. Vidal: La Semaine Medicale, p. 351.
1905. Hawk, P. B.: A study of the conditions following the establishment of the Eck Fistula in dogs. American Journal of Physiology, 1905, xiii, Proceedings, 14.
1905. Sweet, J. E.: "The artificial anastomosis between the portal vein and the vena cava inferior—Eck's Fistula." Jour. of Exper. Med., vii, No. 2, April 25, 1905.
1905. MacLeod and Haskins: "Contributions to our knowledge of the Chemistry of Carbamates." Jour. Biol. Chem., 1905, i, p. 319.
1905. Rothberger and Winterberger: "Ueber die Giftigkeit der Fleischnahrung bei Hunden nach Ausschaltung der Leber aus dem Portalkreislauf (Eck'sche Fistel)." Arch. internat. de physiol., ii, pp. 140–141, 1905.
1906. Carrel and Guthrie: Uniterminal and biterminal venous transplantations. Surg., Gyn. and Obstet., 1906, ii, 266. Also "L'anastomose des Vaisseaux sanguins par la methods du 'patching' dons la transplantation du rein." C. R. de la S. de B., 1906, lxi, 276; ibid., lx, 1104.
1907. Carrel, A.: "The Surgery of the Blood-vessels, etc." Johns Hopkins Hosp. Bull., January, 1907.
1907. Sweet, J. E., and Levene, P. A.: "Nuclein Metabolism in a dog with Eck's Fistula." Jour. of Exper. Med., ix, No. 2, March, 1907.
1907. de Filippi: "Der Kohlehydratstoffwechsel bei Hunden, die mit Eckscher Fistel, nach der Pawlowschen Methode (direckte Einführung des Pfortablutes in die Vena cava mit Unter hindung der Pfortader) operiert wurden. Ztschr. f. Biol., 1907, xlix, 511.
1908. de Filippi: "Der Kohlehydratstoffwechsel bei mit der Eckschen Fistel Pawlowscher Methode (direckte Einführung des Pfortaderblutes in die Vena cava mit Verschluss der Pfortader aus Leberhilus) operierten Hunden." Ztschr. f. Biol., 1908, i, 38.
1908. Hawk: "On a series of feeding and injection experiments following the establishment of the Eck Fistula in Dogs." Amer. Jour. Physiol., 1908, xxi, 259.
1909. Voegtlin and King: J. Biol. Chem., 1909, xi, Proceedings.
1909. Whipple and Sperry: "Chloroform Poisoning, Liver Necrosis and Repair." Johns Hopkins Hospital Bull., 1909, xx, 278.
1909–1912. Matthews, S. A.: "The effects of Eck fistula on the liver (dog's)." Trans. Chicago Path. Soc., 1909–12, viii, 263–266.
1910. Guthrie: "Survival of Engrafted Tissues.—III. Blood-vessels." Heart, 1910, ii, 115.
1911. Bernheim, B. M., and Stone, H. B.: "Lateral Vascular Anastomosis." Annals of Surgery, October, 1911, p. 496.
1911. Abel and Macht: "The Poisons of the Tropical Toad, Bufo Aqua." Jour. Amer. Med. Assoc., 1911, lvi, 1531.

1911. Frouin, A.: "Nouvelle technique de la fistule d'Eck." Presse med., Paris, 1911, xix, 976, 980.
1911. Frouin, W., and Jeanne, P.: "Nouvelle technique de la fistule d'Eck." Compt. rend. Soc. de biol., Paris, 1911, lxx, 954–956.
1911. Fischler, F.: "Weitere Mitteilungen zu den Beziehungen Zwischen Leberdegenerationen und Pankreasfettgewebsnekrose an Tieren mit Eckscher Fistel und über die Möglichkeit ihre Verhütung." Deutsches Arch. f. klin. Med., ciii, p. 156, 1911. Ibid., civ, p. 300.
1911. Grafe and Fischler: Ibid., civ. p. 319, 1911.
1911. Michaud: "Über den Kohlenhydratstoffwechsel bei Hunden mit Eckscher Fistel," Verhandlungen d. Kongr. f. innere Med., 1911, xxviii, 561.
1911. Voegtlin and Bernheim: The rôle of the Portal circulation of the liver in bile formation and jaundice. Jour. Pharm. and Exper. Ther., 1911, ii, 455.
1912. Towles and Voegtlin: "Creatine and creatinine metabolism in dogs during feeding and inanition with especial reference to the function of the liver." Jour. Biol. Chem., 1912, x, 479.
1912. Bernheim, B. M., and Voegtlin, C.: "Is the anastomosis between the portal vein and the vena cava compatible with life?" Johns Hopkins Hosp. Bull., Baltimore, 1912, xxiii, 46–49, 1 pl.
1912. Guthrie, Charles C.: "Blood-vessel Surgery and its Applications." Univ. of Pittsburgh, December, 1911.
1912. Fischler und Bardach: "Über Phosphorvergiftung am Hunde mit partieller Leberausschaltung." Zeitschr. für Physiologische Chemie, lxxviii, 1912.
1912. Rosenstein, Paul: "Über die Behandlung der Leber-cirrhose durch Anlegung einer Eckschen Fistel." Archiv. f. klin. Chir., 1912, xcviii, p. 1082.
1912–1913. Jeger, E.: "Die Operationstechnik der Eckschen Fistel." Internat. Beitr. z. Path. u. Therapy. d. Ernahrungsstoffwechs. u. Verdaungskr., Berl., 1912–13, iv, 1–9.
1913. Fischler und Kossow: "Vorläufige Mitteilung über den Ort der Acetonkörperbildung usw. Deutsch. Archiv. f. klin. Med., cxi, 1913, 479.
1913. Hassan, Reschad, and R. duBois-Reymond: "Zur Technik der Eckschen Fistel." Archiv. für Anatomie und Physiologie, 1913, 325–328.
1913. Bernheim, B. M.: "Surgery of the Vascular System." Baltimore, 1913.
1914. Rosenstein, P.: "Autodrainage of Ascites into the Bladder." (Ventilbildung an der Harnblase zur Ableitung der Ascitesflüsskeit). Zentralblatt für Chirurgie, Leipsic, Feb. 28, 1914, xli, No. 9, pp. 369–416.

Dr. J. E. Sweet was somewhat inclined to disagree with Dr. Peet's view of von Eck's work; von Eck succeeded in having a dog live over a year, and that was 38 years ago.

The operation is perfectly feasible and the results are entirely compatible with life, except in one point; the animals he had had living a long period, the longest being 3½ years, died of evident cirrhosis of the liver. Nevertheless, the operation is indicated for cirrhosis of the liver; it is certain that there is no other definite relief for the back

pressure in this condition. About a year ago last fall, he worked out on the cadaver a method of doing the Eck fistula, consisting in the anastomosis between some of the radices of the portal vein and the iliac, and found it was very easily accessible and easy of accomplishment. Thereupon, Dr. Edward Martin and he, in his service at Blockley, attempted it twice. It seemed that the indications were perfectly clear in each case; in the first they opened the abdomen supposedly for cirrhosis of the liver, but found this diagnosis to be incorrect, there being a condition of syphilis of the liver and spleen. The Talma operation was performed. In the second case they were unable to exactly determine the condition but it was also thought to be syphilis.

Dr. Charles H. Frazier referred to his own experience with omentopexy. His first Talma operation was analogous in one respect to his first Edebohls's operation, both were suitable cases and in both the results were extraordinarily brilliant. The patient was a middle-aged man, alcoholic, with marked cirrhosis of the liver and with no organic changes in the kidney or heart. Although he had to be tapped two or three times after operation, from that time on for five years, when he lost track of him, the ascites did not return. He had performed the Talma operation on four or five cases since then, but in none of these did he now recall, has there been any striking relief for the condition for which the operation was performed.

With regard to the indications for, or the preference for, the Eck fistula over the Talma operation, it seemed to him that in suitable cases they would be justified in recommending the Eck fistula, provided it can be done by those experienced in blood-vessel surgery. In the case of a young woman, from whom he had removed the spleen a year ago for Banti's disease and who had developed secondary changes in the liver with marked ascites, after careful consideration, they decided to make an Eck fistula, but at the operation the adhesions were so abundant and of such character, that they could not expose vessels suitable for anastomosis. As to the operation requiring the hands of a surgeon experienced in blood-vessel surgery, he had had the opportunity of assisting Dr. Peet several times in Eck fistula operations on animals and had been surprised to find with what facility the operation is performed by experienced hands. In the human subject as in dogs, it ought to be attended with no shock and with no infection. The operation is of short duration and the mortality should not be higher than that of the Talma operation, which necessitates so much intentional trauma of the peritoneum.

Dr. Astley P. C. Ashhurst asked if experimental surgeons have

succeeded in producing ascites by obstruction of the portal vein. Theoretically, this will produce enlargement of the veins in its distribution on the mucous surfaces of the gastro-intestinal canal, but will not produce ascites. Hale White, Rolleston, A. O. J. Kelly and others have maintained that a patient with uncomplicated cirrhosis of the liver never lives long enough to be tapped more than once; in other cases the ascites may be due to changes in the peritoneum, perhaps tuberculous, or possibly syphilitic, or due to some other infection. Therefore, the establishment of an Eck's fistula seems an irrational procedure for the relief of ascites; and the relief of the ascites, which sometimes follows epiplopexy, probably is not due to the establishment of a collateral circulation, but to the trauma to the peritoneal surfaces which is an essential part of Talma's operation. The indication for the establishment of a collateral circulation is gastro-intestinal hemorrhages, and not ascites alone.

OSTITIS FIBROSA CYSTICA

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Acute intraosseous diseases of the long bones possessing a more or less clear etiology and definite clinical characteristics, present little or no difficulty in diagnosis, prognosis or treatment. With the quite multitudinous variety of affections of a chronic nature that may involve the same structures, the conditions and problems with which the surgeon has to deal are wholly changed. That quite different and definite pathological entities, some requiring little or none and others very extensive operative procedures, may be represented by essentially like clinical phenomena, is well known. This necessitates the most searching and scientific analysis of this group of cases, not simply from the academic standpoint but as an insurance of the ultimate welfare of the patient, for we must rely entirely upon exactness of diagnosis for a guide to the proper prognosis and treatment.

Upon a broad morphological basis we may subdivide the chronic intraosseous affections into:

1. Those dependent upon infection.
2. The purely metaplastic processes.
3. The neoplastic, which are either benign or malignant.

In the first group we encounter tuberculosis, lues and chronic osteomyelitis, primary or secondary, either diffuse involving large areas or circumscribed in the form of an abscess, the so-called ostitis albuminosa. The last group is represented chiefly by the sarcomata which vary greatly in their malignancy, and by the more rare and benign growths, enchondromata, myxomata and fibromata. In the second group or metaplastic type the one of chief importance is dependent upon that peculiar metamorphosis of a part or a whole of a single or many bones of the skeleton into fibrous tissue with a decided tendency to the formation of cysts.

Although previous to 1876 sporadic cases of bone cysts had been reported from autopsy findings, it was not until this date that Virchow definitely drew attention to their occurrence. Thirteen years later Hirschberg first observed and described ostitis fibrosa, but looked upon

it as a late stage of osteomalacia with the formation of cysts. Its identity as a separate disease was not established until 1891, when von Recklinghausen published his monograph. From this time until within the last few years little but academic interest was shown. In 1902 Koch collected 23 cases, while Heineche, in 1903, published the report of the first case of bone cysts in which radiographic pictures were made. This was followed by the collection and study of 43 cases by Muller in 1906. Pfeiffer's paper appeared one year later and Bloodgood's in 1910 with analysis of 69 cases reported up to that date. Now that the radiograph has enabled the discovery of its rather frequent occurrence, we can no longer neglect its consideration in the study of many cases of obscure intraosseous lesions. It is with the hope of adding slightly to the slowly accumulating knowledge in regard to bone cysts that the report of our cases is made.

That a cyst of bone may result secondarily from any of a number of primary pathological changes is of course patent and is recognized by all writers on this subject. In reviewing the cases of bone cysts found in the literature, one sees that much confusion has arisen from this intermingling of secondary cystic changes or degeneration in other processes with those cases of true simple cysts. According to Silver, "the term 'bone cyst' should be used in a more specific sense to include those cases within the bone of a cavity filled with fluid as the most prominent symptom and in which no other definite disease can be discovered either from examination of the cystic contents or of the surrounding bone." Assuming that this restriction is reasonable and correct, we must exclude from the true bone cysts those dependent upon or secondary to:

1. The liquefaction of subperiosteal hæmatomata which have become included by a surrounding shell of reactionary ostitis.
2. Cysts occurring occasionally in callus.
3. Those resulting from the breaking down of neoplastic growths, sarcoma, myeloma, fibroma, myxoma and enchondroma.
4. Those appearing at times in Paget's disease and arthritis deformans.
5. Cystic changes in osteomalacia.
6. Echinococcus cysts.
7. Dentigerous cysts.
8. Cysts accompanying von Recklinghausen's disease or general ostitis fibrosa.

No sharp distinction can of course be made between the latter and the cysts under discussion, except that of its limitation to one bone in

which the cyst formation is the prominent change while in general ostitis fibrosa they are of minor importance.

The essential underlying process leading to the production of cysts is ostitis fibrosa of the type limited to a part or whole of a single bone. Although the nomenclature would place it among the inflammatory types of intraosseous affections, it cannot essentially be regarded as such, various opinions to the contrary, notably Bloodgood, who states, " I agree with all the more recent writers that the disease is an inflammatory one, in which the medullary tissue is replaced by a new formation of connective tissue with or without cyst formation and that the term ostitis fibrosa is not an inappropriate one, although it would appear that the term chronic osteomyelitis fibrosa cystica or solida would describe the condition more fully." Murphy is also of the opinion that it is an inflammatory process. While it may be a metaplastic process dependent upon a foregoing inflammation of a chronic attenuated character, in itself it has none of the ear marks which we associate with inflammatory changes. Its almost invariable situation at first in the centre of the bone, always at first a medullary occupant, its equal expansion in all directions with no sign of surrounding regeneration or thickening or active periosteal overgrowth, and the preservation of the latter in unbroken outline even when the periosteum is in direct contact with the cyst wall, all argue against our concept of osseous inflammation. On the other hand, the pathological picture of ostitis fibrosa is a strong witness for its metaplastic nature. The metamorphosis of the marrow into masses of fibrous tissue with subsequent degeneration of these fibrous masses into serous, mucoid or fatty material, portions showing cartilage or bony formation, all you will note of the same embryological type, corresponds perfectly with the changes in true metaplasia. This similarity has been well brought out by Freiberg.

The process usually shows a single cyst, of varying sizes, often egg shaped, with or without a lining membrane, the surrounding bone the seat of ostitis fibrosa. Cysts may, however, be multiple, unilocular or multilocular, the walls smooth or deeply ridged. Their contents have almost invariably been serous or blood-stained serous fluid. The cyst of the fifth metacarpal bone reported by McDill last October, when opened, discharged stringy mucopus. This cyst was not obviously one of those under discussion, occurring in a woman of sixty-five and apparently secondary to chronic osteo-arthritic disease. It should not be placed among the primary bone cysts.

The presence or absence of a lining membrane, except the greater possibility of secondary neoplastic change, is apparently of little practical importance while it is possible that the lining is an asset acquired during the later life of the cyst. Engel's case of multiple cysts in which the smaller and presumably the younger cysts did not possess a lining while the larger ones were lined by a membrane of some thickness is suggestive, while even more convincing is the case reported by Silver where at a second operation for recurrence of a cyst of the upper end of the femur, in a boy of four years, a distinct lining membrane was found where at the previous operation twenty months before, the most careful examination failed to reveal any but a smooth, bony wall.

My first case which I am enabled to report through the kindness of Dr. Frazier, is also illustrative of the lining membrane being an acquisition of the more mature cysts.

M. T., male, aged twenty, Polish, was admitted to Dr. Frazier's service at the University Hospital, October 1, 1913. A miner by occupation, two weeks previously he had been struck on the dorsum of the first metacarpal of the left hand by a piece of falling rock. This caused a slight wound ½ cm. in length which bled profusely and had continued to bleed at each dressing, being controlled with difficulty up to the time of admission. Fifteen years previously, or at the age of five, there had been noticed a swelling at this spot which increased gradually but without pain or interference of function. Between that time and the date of migration to this country, three years ago, two operations had been performed for this swelling. What was done or the nature of the process was unknown to the patient, who was very illiterate and from whom a detailed history could not be obtained. The wounds, however, always healed quickly and there was little or no change in the progress of the enlargement following these procedures. There had never been any pain and up to the last two weeks no tenderness or lameness. The patient had never been ill and absolutely denied venereal infection. Nothing was discoverable upon a general physical examination. There was no increase in leucocytes and the blood Wassermann was negative. Upon local examination, there was considerable swelling over the whole region of the metacarpal, which was enlarged, irregular in outline but smooth, except at the point of injury, where it was thought sharp edges of bone could be felt at the junction of the distal and middle thirds of the bone. The wound was slight, surrounded by quite an area of pigmentation and several enlarged veins. Only one scar was discoverable which was parallel with the long axis of the bone and 2½ cm. in length. The wound bled extremely freely and upon probing, bone was easily felt at the bottom. Temperature was 98.6°; pulse 72, respirations 20.

The clinical diagnosis was chronic osteomyelitis with possible incomplete fracture at the site of the injury. The radiograph, however, was somewhat disconcerting (Fig. 1). It shows the whole bone tremendously enlarged, affecting all but the epiphysis. There is apparently no thickening of the periosteum which appears intact. The rarefaction or honeycombed appearance of the entire diseased area was remarkable, while no distinction between medulla and cortex

remained. This picture is more suggestive of a specific origin of the condition. Through the kindness of Dr. Frazier, on October 15, under gas-ether anæsthesia, I exposed the bone by a longitudinal incision 2½ cm. in length with the wound at its centre and excising the old scar. Upon exposure, the periosteum was intact, but as soon as this was incised, the hemorrhage was profuse and continued to ooze from the bone. The exposed bone was extremely rarefied, fragile and consisted of many small liquified areas surrounded by the thin fragile shells. The contents of the cells was for the most part a thin gelatinous substance, but at places free blood and active bleeding was encountered. Bearing in mind the presence of enlarged veins over the site of the tumor, the radiographic picture and the gross appearance of the bone, I was inclined to think that the process was neoplastic rather than inflammatory. I therefore enlarged the incision and excised the bone *in toto* with its periosteum. The joint surfaces were uninvolved, but the surrounding tissues were like the bone the seat of greatly increased vascularity. Hemorrhage was controlled with difficulty and the wound closed without drainage, the hand dressed in extension. With the exception of some slight superficial infection, the wound healed without reaction.

The pathologic histology proved all previous diagnoses erroneous. The excised bone was 8 cm. in length, the external surface rough and irregular, containing in some places normal periosteum, but for the most part this covering was thickened with fibrous tissue and contained many points of calcification. The articulating ends of the bone were normal in appearance, their surface smooth and regular. Section in the longitudinal axis revealed a surface presenting a honeycombed appearance, the structure being made up of a trabecular bone formation containing many minute cavities and a few larger ones about the size of peas. The contents of these cysts was putty colored, soft in consistency, and in some places yellowish in color, evidently containing fat.

Microscopic examination of this putty-like material revealed a few fat droplets and a homogeneous structureless substance. Section of decalcified bone showed a dense fibrous overgrowth associated with many bone trabeculæ. The compact bone itself showed evidences of rarefication and cyst formation, the Haversian canals being dilated beyond their normal calibre and in many free blood was seen. Some of the larger of the cysts are lined with a cellular formation which resembles recently formed granulation tissue, in that it consists of many leucocytes, embryonic connective tissue and new blood-vessels. The ground substance of the decalcified bone consisted in part of cartilage, of true bone and of areas in which the transition between cartilage and bone was apparently taking place. The gross and histological picture corresponds to the disease described as ostitis fibrosa cystica.

On the third day following operation, the temperature was normal and remained so thereafter. On November 5, or twenty-one days later, a section of rib 6 cm. in length was transplanted by Dr. Frazier to take the place of the excised bone. Fig. 2 shows this graft in position one week later. Again the wound healed *per primam*. The patient was discharged from the hospital on December 1. He could move the forefinger at the metacarpophalangeal joint through an arc of 35°. Efforts have been made to get into touch with this patient to learn the later results, but so far I have been unsuccessful.

Reported cases show that simple cysts may be located in nearly every bone of the body, even the skull, although I have not found any mentioned as occurring in the ribs or vertebræ, and but one case has been previously mentioned where the metacarpal bone was affected. Bloodgood, in a review of 65 cases of simple cysts, found none. Muller did not find any of this bone. Pfeiffer records one which is also mentioned in Silver's list. McDill's case, already mentioned, cannot be admitted because, from its contents, it was undoubtedly of infectious origin. In 50 cysts collected by Muller, 38 per cent. were in the femur, 22 per cent. in the tibia and 16 per cent. in the humerus, the three bones most frequently affected. Bloodgood reverses this order and places the humerus first and tibia last. Of Pfeiffer's 49 cases, 19 were in the femur, 14 at the upper end, 12 of the tibia with 9 at the knee, and 10 of the humerus with 8 at the shoulder. Silver in a very thorough review of the literature up to 1911, collected 97 true bone cysts. Of these, 31 were in the femur, 25 in the humerus, and 15 in the tibia.

Since Silver's paper, six cases besides the three to be reported tonight, have been put on record. Canaguier reports one of the upper end of the humerus, Ashhurst one in the same position, Murphy reports two of the humerus, both at the shoulder, one at the upper end of the tibia, and one of the femur at the hip. The case of multiple cysts reported by Percy is not admitted because more than one bone was involved. So, also, McDill's case for the reasons already given. This brings the list of true bone cysts reported up to the present up to 103. of which 32 are of the femur, 29 of the humerus, and 16 of the tibia. To this number I wish to add the following case, which occurred on Dr. Frazier's service at the University Hospital in September, 1911.

C. S. (Univ. of Penn. Hosp., No. 10124), male, aged fourteen, was admitted to the hospital on account of pain and tenderness in the right thigh above the knee. Twenty-one months previously he had fallen while sliding on the ice, hurt his right thigh, and had some pain and limping, lasting but a few days. One month later he fell again, was picked up unable to walk and taken to a hospital, where he was treated for a fracture of the right femur about three inches below the trochanter. He was in the hospital for three weeks and was discharged with the limb in a cast. This was removed at the end of another two weeks. After a period of some disability and limping, he had no further pain or tenderness, although he noticed that the right leg was slightly shorter than the left. On the day of his admission, he was running when without any apparent cause the right leg suddenly gave way and he fell in a heap. He had considerable pain localized to the site of the old fracture which was marked by a lump on the outer side of the thigh. Family and personal history were absolutely good and there was no suspicion of lues. General physical examination showed a normal healthy boy of fourteen.

The right thigh at the juncture of the middle and upper thirds showed a well marked outward angulation with projection of a hard, rounded, irregular bony mass the size of a large orange. On slightest movement he complained of severe pain running through the tumor, but no crepitus or preternatural mobility could be elicited. There was a shortening of one inch between the tip of the great trochanter and the external malleolus on the affected side. There was distinct eversion of the right foot which the patient could not correct. The patient later stated that the tumor on the outside of his thigh had been present with gradually increasing size ever since his first accident.

The radiograph (Fig. 3) shows the large cyst surrounded by normal appearing bone situated at the site of the former fracture and a second incomplete fracture breaking in to the cystic cavity. For seventeen days the limb was kept in extension with side splints which resulted in a reduction of the shortening to one-half inch. In the meantime, however, the radiograph had shown the presence of two other cysts of almost the same size and separated from the first by thin bony partitions. On October 7, under gas-ether anæsthesia, the patient was operated upon by Dr. Muller. Through a longitudinal incision directly over the tumor, the bone and site of fracture were exposed, the cysts opened, curetted and allowed to fill with blood clot. The walls of the cavities were smooth and lined with a thin membrane resembling newly formed granulation tissue in that it was soft and easily bled. The wound was closed without drainage, while the Buck's extension and side splints were reapplied. The wound healed perfectly, convalescence was normal, and on November 18 the patient was discharged with good functional result and legs of equal length. Fig. 4 is a reproduction of the radiogram taken one month after operation, and shows union at the point of fracture with beginning obliteration of the cysts as evidenced by the decreased translucency. Fig. 5 is the radiogram taken two months after operation, showing still further reduction of the cysts.

It is, of course, questionable whether or not the ostitis fibrosa was present previous to or resulted from the trauma of the first accident. From the comparatively slight traumata to which the limb was subjected in all three injuries, it seems more probable that the process had already begun prior to the injury 21 months before.

The cysts almost invariably occur in the metaphysis, near the epiphyseal line, but practically never invading the epiphysis itself. Situated most frequently in the upper or lower one-third of the shafts of the long bones of the extremities, it is five times more frequent in the proximal than in the distal ends, while in the humerus and femur it is situated at the shoulder or hip seven times to once at the elbow or knee.

Ostitis fibrosa, the underlying or primary stage of cystic disease, is undoubtedly an affection of the developmental age of bone. Thus in childhood and adolescence by far the greater number of cases come to notice. In Pfeiffer's 49 cases, 70 per cent. occurred prior to twenty years of age, and 85 per cent. before thirty. This is comparable to

FIG. 1.—Ostitis fibrosa cystica of second metacarpal bone.

FIG. 2.—Same as Fig. 1, after excision, showing transplant in position one week later.

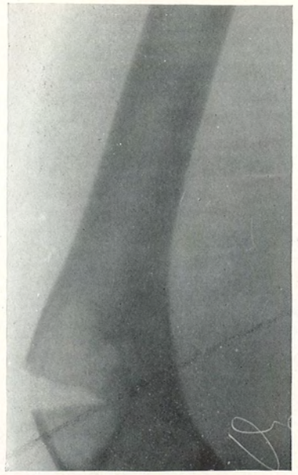

FIG. 3.—Radiograph of Case II on admission. Shows the largest of the cysts and line of spontaneous partial fracture.

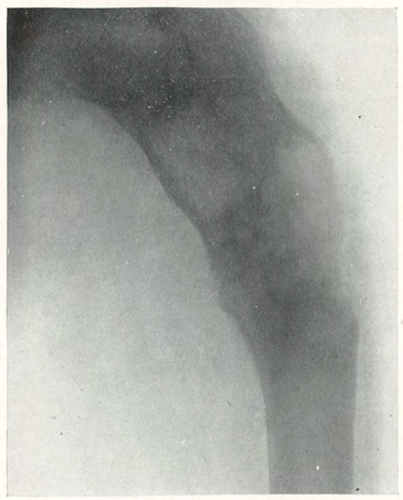

FIG. 4.—Radiograph in second case, male aged fourteen. One month after operation. Cavity filled with clot. Shows union of fracture and beginning obliteration of cysts. Shows other cysts.

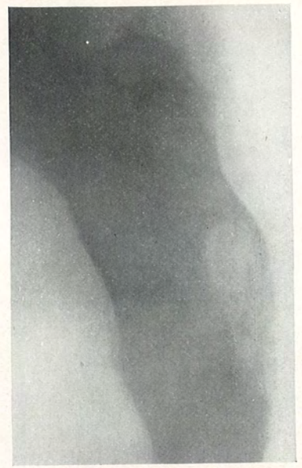

FIG. 5.—Second case two months after operation. Shows almost complete resolution and obliteration of cavities.

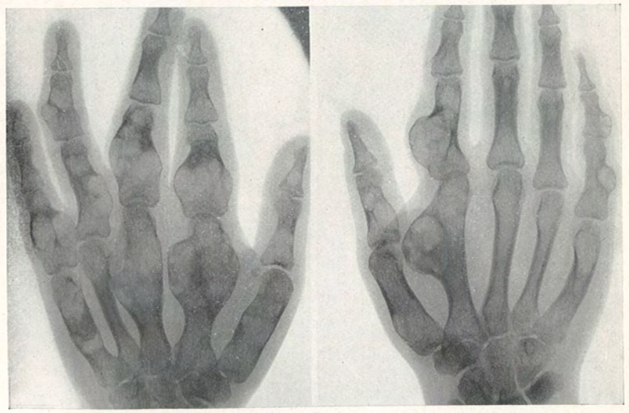

FIG. 6.—Multiple enchondromata of both hands, showing cyst formation in first and second phalanges of fifth finger, right hand. Female, aged eighteen.

FIG. 7.—Radiogram in case of ostitis deformans of femur. Note great thickening and overgrowth of bone with rarefaction and eburnation occurring simultaneously. Male.

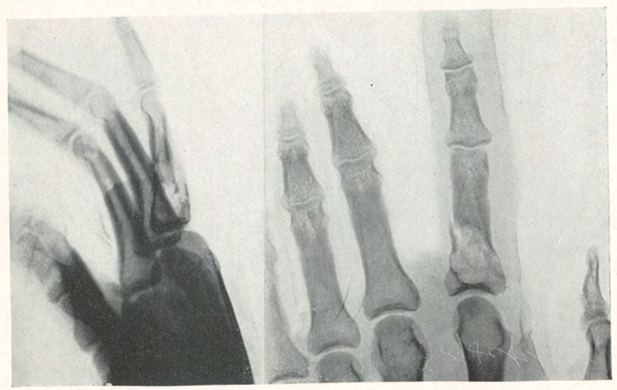

FIG. 8.—Radiograph in Case III. Fracture at site of cyst in base of proximal phalanx of index finger.

FIG. 9.—Radiogram of Case III taken two years after fracture. Practically no change in the cystic condition but perfect union of the fracture. Male, aged thirty-eight.

FIG. 10.—Osteomalacia. Female, aged one year. Shows cystic changes. Note involvement of epiphyses and of left tibia.

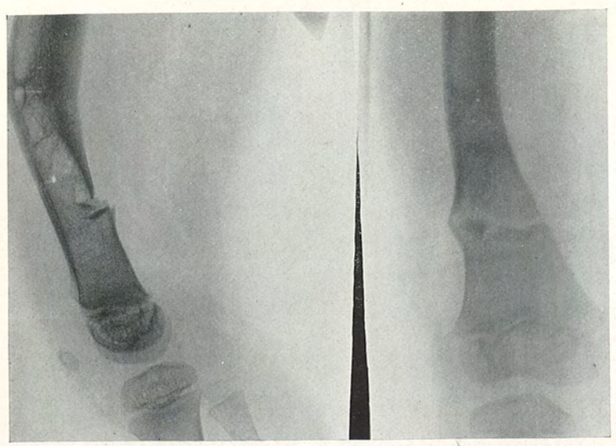

FIG. 11.—Osteomalacia. Discovered accidentally after radiograph for incomplete fracture caused by stumbling. Note compensatory hypertrophy of femur, bracket formation. Female, aged three.

FIG. 12.—Specific dactylitis. Involvement of epiphysis.

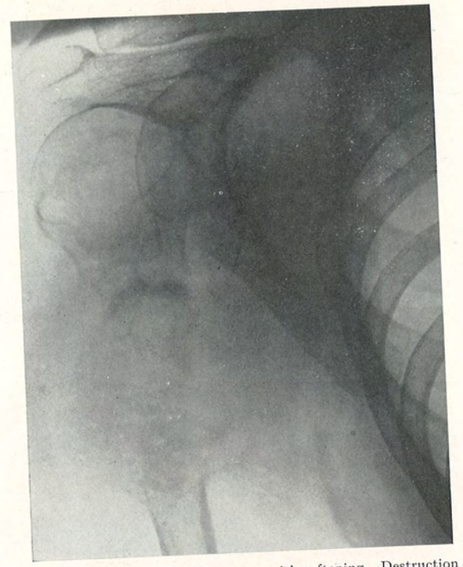

FIG. 13.—Medullary sarcoma upper end of humerus, with softening. Destruction of bone, fracture and involvement of soft tissues.

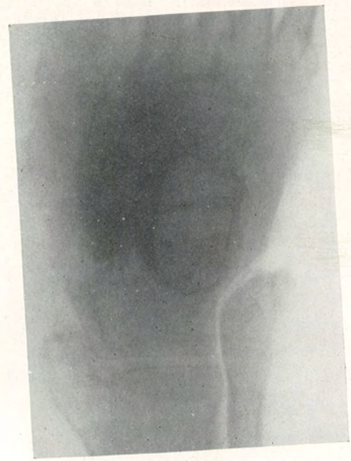

FIG. 14.—Radiogram of sarcoma of tarsus with beginning cystic changes in the centre.

Muller's series in which 67.5 per cent. were before twenty and 82.5 per cent. before thirty. In tabulating 97 cases, Silver found 67 per cent. between two and one-half and twenty years, while 77.3 per cent. were before thirty. Lack of detail in the reports of many cases probably places many of them at a much later age than they should be. The disease is so insidious, giving little or no disability and few symptoms, that it may be overlooked for many years. The youngest case reported was in a child of two and one-half—Silver had a case with onset at three years—while the average age of the 106 cases on record including the three reported here is twelve and one-half years. One sex is equally affected with the other.

The etiology of the benign bone cysts remains shrouded in obscurity. Various opposing theories without confirmatory evidence have been proposed. Thus Virchow believed them due to the softening of cartilaginous tumors. While cystic degeneration does undoubtably occur in chondromata, they cannot be considered identical with the cysts we are now dealing with. As Bloodgood states, " Cartilage is never present in sufficient quantity to justify the conclusion that the cyst is due to the liquefaction of a primary or original area of cartilage." Fig. 6 shows the radiogram of the hands of a patient, 18 years of age, suffering from chondromatous growths. They are identified chiefly from their multiplicity, their preference for the epiphysis and the peculiar mottled appearance so well illustrated in this specimen. Two of the growths, on the fifth finger of the right hand, have undergone cystic change.

Beneke likens these cysts to the apoplectic cysts of the brain, the hemorrhage, caused by an initial trauma, for some reason or other is neither absorbed nor does it become organized. Others, notably Lubarsch, and Röpke, believe that they result from infection. They have found organisms in the cyst contents. Von Recklinghausen in 1911 stated that most benign cysts were due to ostitis fibrosa, the solitary cysts to a localized form of this disease. As to the cause of ostitis fibrosa, von Recklinghausen believes that trauma or some mechanical factor is the important agent. Boit considers that it may result from various causes, infectious, metabolic, traumatic, toxic or perverted internal secretions. Rehn likens it to the snuffle disease of hogs, an overdevelopment of a normal process, while Bockenheimer believes ostitis fibrosa and Paget's disease one and the same, pathologically. Fig. 7 shows the radiogram of a case of ostitis deformans in a male well within the age of the occurrence of ostitis fibrosa. One notes at once the difference between this process and the latter, the extreme rarefaction

without the clear picture of cyst formation, the areas of rarefaction going hand in hand with areas of bone proliferation and eburnation, great thickening of the periosteum on the inner side and obliteration of the marrow cavity with true bone formation.

The balance of evidence is undoubtedly in favor of trauma as the initial factor in most cases. Thus in the 97 cases collected by Canaguier, the author states that trauma was known to precede the cystic formation in about two-thirds of the cases. Its occurrence during the developmental age when the bones are more susceptible to traumatic influences, and when repeated traumata are most frequent, their situation in the long bones which bear the brunt of blows and falls, and at positions in these bones receiving the balance of strain and where the cancellous tissue is most pronounced, all favor this explanation.

Benign cysts of bone like other chronic intramedullary diseases, have little symptomatology of their own, until they have progressed to the stage of causing interference in function, deformity, encroachment upon more sensitive structures, as the periosteum, causing pain, or so weakening the bone as to permit fracture from slight trauma. They may exist for years without giving any noticeable symptoms and be discovered accidentally by the radiograph. Most commonly the initial symptoms are local swelling or deformity. Pain is not a prominent symptom, when occurring is usually slight, often varies with atmospheric conditions, the so-called rheumatic type. When severe, some other condition should be suspected. Silver mentions pain as the initial symptom in 25 per cent. of his cases.

Fracture is the chief feature if not the most common symptom of cyst, as it is frequently the reason for seeking surgical aid. Fracture usually occurs spontaneously or by slight trauma and may recur with good healing in the intervals several times. Thus in a case recorded by Murphy in a boy aged twelve, with a cyst in the upper extremity of the humerus, the initial symptoms were slight variable lameness and tenderness, followed during the course of a year and a half by four incomplete fractures from slight traumata. In the 49 cases collected by Pfeiffer, pathological fracture occurred in 20. The following case is illustrative of the often symptomless course of this disease prior to fracture. I am indebted to Dr. G. V. Janvier, of Lansdowne, Pa., for opportunity of studying this case.

J. H., aged thirty-eight, a janitor. In May, 1912, he was holding a horse by the halter. The horse suddenly jumped, causing a sudden tightening of the man's grip in the halter ring, when he felt the index finger of his right hand suddenly give away. Pain, tenderness and disability were so great that he consulted his physician, Dr. Janvier, who diagnosed fracture of the proximal phalanx and referred the patient to Dr. Pancoast for radiography. The radiogram (Fig. 8) shows an oblique splitting fracture of the phalanx running upward and forward through a cyst and entering the joint. This was the first evidence that a cyst existed. The patient had never to his knowledge injured this finger, had never had any pain, stiffness or tenderness in this hand and had always been in excellent general health. The fracture was reduced, kept on splints for three weeks, healed perfectly, and since then he has experienced no pain or tenderness. There is limitation of motion in flexion, this function is capable through an arc of only 45 degrees. This is probably due to involvement of the joint in the fracture. At present there is only slight enlargement of the bone. Fig. 9 shows the condition as it exists at present, perfect union with very little change in the cyst itself. Fractures involving cysts almost invariably undergo perfect union. Egg-shell crackling when the cyst has become so large as to be covered only by the thinnest shell of bone is sometimes encountered.

As stated in the beginning of this paper, the diagnosis of the benign cysts from other more malignant growths requiring vastly different treatment, is of essential importance. The characteristics distinguishing these benign lesions are their latent and long continued growth, with few or no subjective symptoms, their age of onset, their position most often in the extremities of the humerus, femur or tibia, never invading the epiphysis or joint, the frequency of spontaneous fracture, and the characteristic radiographic picture. The latter usually shows "a uniform, often egg-shaped, expansion of the bone, which gives the impression of having started from the middle and expanded equally in all directions; the central portion is definitely translucent to its very circumference, but mottled in varying degrees depending on the varying thickness of the cortex, the presence of ridges, or multiplicity of cysts; the cortex is thinned and narrow, but well marked and regular; the epiphyseal line is not involved."

From most other diseases of a benign nature the radiographic picture will differentiate. Figs. 10 and 11 show rarefaction and cystic change in osteomalacia, Fig. 11 disclosing a pathological fracture and the first intimation that other disease existed. Fig. 12 is of a specific dactylitis, showing overgrowth and thickening of the entire phalanx, distinctly different picture from that of ostitis fibrosa, which never shows bone proliferation and the enlargement takes place only from the expansion of a cyst if present.

The lesion of prime importance in the diagnosis is sarcoma and particularly the benign medullary sarcoma or myeloma. While the latter is still intramedullary, it may be impossible from the radiogram of differentiation from ostitis fibrosa cystica. Its more destructive rather than

expansive character, the early appearance of pain and interference of function, the more rapid growth, its irregular progression, indefinite outlines, its opacity, its early rupture through the periosteum and the involvement of surrounding parts, will usually aid in the diagnosis. Bloodgood states that no case of the more malignant forms of sarcoma of bone has come under notice after the process had been present more than two years—while in the benign bone cysts the symptoms bringing the patient to the surgeon are of much longer duration or unnoticed until the time of fracture. Figs. 13 and 14 show the characteristic appearance of sarcoma in the radiogram, Fig. 13 of the upper end of the humerus with destruction of bone, pathological fracture and invasion of the soft structures of the shoulder. Fig. 14 shows the growth involving the tarsus with cystic degeneration in the centre. The differing appearance of enchondromata has already been mentioned. Ostitis albuminosa has its own characteristics, the irregularity and moth-eaten appearance of the walls, the surrounding condensing ostitis, the usual periostitis and the probable presence of sequestra.

Appearances of a like nature, plus the history and the Wassermann reaction, usually serve to distinguish a centrally placed gumma. It should be remembered, however, that at times even with all the facilities of modern diagnostic methods and long experience, a correct diagnosis is impossible prior to exploratory incision which should be done in all cases of doubtful nature, hence the necessity on the part of the operator of having the necessary pathological training in recognizing these conditions microscopically.

The treatment of benign cysts is either watchful waiting, or operative. The former is rarely justified unless the diagnosis is absolutely assured. If the expectant treatment is adopted, proper support to the bone, the correction of any deformity, and the use of methods for stimulating bone production should be employed. Cysts have healed or disappeared without operative interference, some without but most of them after pathological fracture with drainage of the cyst contents into the tissues and very probably the filling of the cavity with blood and serum from the line of injury.

The operative treatment has varied, all with good results, from simple puncture and injection to excision of a whole or part of the diseased bone. Von Mikulicz aspirated a cyst through a small opening in the shell and injected iodoform emulsion with good results. Until recently the more popular treatment seems to have been exposure of the bone, crushing in the wall of the cyst to promote regeneration, and

curettement of the cavity, the remaining excavation may be allowed to fill with clot, or is packed with bone chips, Moorhof's bone wax or bismuth paste. Since the more frequent use of autogenous bone grafts, resection or excision of the diseased area has been more frequently done. Thus Murphy has resected in three cases, twice the upper end of the humerus and once the upper end of the tibia, and replaced the excised portions with tibial grafts. In a cyst of the femur at the hip, after thorough curettement, he placed a tibial graft in the remaining excavation. Canaguier resected the upper end of the humerus and grafted the tibial crest. Both operators have had uniformly good results. Ordinarily, however, except in the small bones of the hands or feet and in the hands of most operators, resection is not justified if the diagnosis is certain.

Conclusions.—1. Benign bone cysts are much more common than formerly supposed.

2. Limited as true simple cysts, they are distinct entities, most probably dependent upon a localized ostitis fibrosa.

3. The cyst is neither concomitant nor dependent upon other diseases.

4. They adhere more to the metaplastic picture than to the inflammatory or neoplastic, although they may result secondarily from a chronic attenuated inflammatory process.

5. Their etiology, unknown, seems in the large percentage of cases to be associated with trauma during the susceptible growing period of life.

6. They have little or no symptomatology prior to the stage of bone weakening, permitting spontaneous fracture or fracture from slight trauma.

7. Their chief importance lies in our ability to differentiate between them and other more serious lesions, mainly sarcoma, therefore recognition of their possibility, a careful history, local examination, with proper interpretation of the radiogram, are of the utmost importance.

8. The healing of fractures occurring at the site of cysts is uniformly good and may result in cure of the cyst.

9. Operative treatment, unless one can be quite sure from constant watching that the diagnosis is correct, is always justified.

10. Although in selected cases and in the hands of experienced operators, resection with autogenous grafting has resulted favorably, curettement, crushing in of the walls and primary closure of the wound have been almost universally sufficient to procure a cure.

REFERENCES

Virchow: Monatshefte d. kgl. Akad. d. Wissenschaften, 1876, 369.
Von Recklinghausen: Festschr. Rudolph Virchow, 1891.
Koch: Archiv. f. klin. Chir., 1902, lxviii, 977.
Muller: Univ. of Penna. Med. Bul., September, 1906, p.173.
Pfeiffer: Beitr. Z. klin. Chir., 1907, 473.
Bloodgood: Annals of Surgery, vol. lii, No. 2, 145.
Silver: Amer. Jour. Ortho. Surg., vol. ix, 1911–1912, 563.
Freiberg: Lancet, Clinic, 1913, vol. cix, 504.
McDill: Annals of Surgery, vol. lviii, No. 4, 533.
Engel: Inaug. Dissertation, Geissen, 1864.
Canaguier: Arch. prov. de Chir., October, 1912.
Ashhurst: Trans. Epis. Hosp., 1913.
Murphy: Clinics of J. B. Murphy, vol. i, No. 5; vol. ii, No. 5.
Percy: Surg., Gyne. and Obste., vol. xvii, No. 5, 536.
Beneke: Quoted by Percy.
Lubarsch and Röpke: Quoted by Percy.
Boit: Archiv. f. klin. Chir., xcvii, 515.
Rehn: Beitr. z. path. Anat. u. z. Path., 1908, xliv, p. 274.
Bockenheimer: Arch. f. klin. Chir., 1906, lxxxi, 236.
V. Mikulicz: Zentralbl. f. Chir., 1904, xxxi, 1323.
Jones and Morgan: Archi. of the Röntgen Ray, 1906–1907, No. 11, 316–342.
Elmslie: Brit. Med. Jour., November 16, 1912, p. 1367.
Stumpf: Deutsche Zeitschrift f. Chir., 1912, pp. 114–417.

For a complete list of references and reported cases, refer to the articles of Bloodgood, Muller, Strumpf, and Silver.

Dr. Gwilym G. Davis said that once, years ago, he operated on one case of cyst of the lower end of the ulna by curetting and it has remained well. The subject is comparatively clear when there is a single cyst of the bone, but it becomes more obscure when it is one in which the outlines are not so circumscribed and the tissues become, so to speak, rarefied; in other words, instead of being in two or three large vacuoles, there is a more disseminated rarefaction and also when it advances a little further and involves the outer edge with a possible involvement of the periosteum. Take the cases, for instance, of Paget's disease, of ostitis deformans. They seem to be closely allied to ostitis fibrosa. He remembered reading two or three years ago the report of an Italian case of Paget's disease limited to a single bone like the femur, and he thought, in Dr. Henry Ling Taylor's book on orthopædic surgery, there is an allusion to Paget's disease being limited to more or less distinct bones and not being a general affection. In such a case it would be pretty hard to make a diagnosis not as to the condition exactly, but to classify it; these cases seem to shade one into another all the way from the simple single cyst to the rarefaction of Paget's disease.

A REVIEW OF 100 CONSECUTIVE OPERATIONS FOR GOITRE WITH ESPECIAL REFERENCE TO THE TREATMENT OF HYPERTHYROIDISM

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It is a rather significant fact that with the exception of Halsted, of Baltimore, no notable contributions on the surgery of the thyroid gland have been made by surgeons of the Atlantic seaboard towns. That this should have been so from the earliest days in the development of the surgery of the thyroid gland, I attribute to the geographical distribution of goitre, which is not so prevalent on the coast, but might be said almost to be endemic in regions following the great lakes from western New York and northern Pennsylvania into the territory of the great northwest. It is with some hesitation, therefore, that I venture to discuss the goitre question, and yet we are confronted sufficiently often with complicated problems to warrant a frank exchange of opinions.

Briefly, the review is based upon a group of 103 consecutive operations. I find there were 81 thyroidectomies, and 17 ligations of vessels, and 5 operations for thyroglossal cysts; more specifically there were 34 simple goitres, 29 adenomata, 1 sarcoma, 2 carcinomata and 32 hyperplastic (exophthalmic) goitres. There were 17 ligations, 8 of one and 9 of two vessels. Of the thyroidectomies, there were no fatalities, save one in the case of a large vascular sarcoma in a boy of 11 years. Of the ligations there were two fatalities in patients who, according to our more enlightened conception of the limitations of surgical therapy, would be now regarded as inoperable, at least in the acute phase at which the operation was performed.

Pathogenesis.—As to the pathogenesis of goitre of the endemic variety, there has been a popular belief for many years that in some way drinking water played an important part. This belief, based at first upon purely hypothetical grounds, is receiving more and more substantial support from thorough scientific investigations, the most recent and the most convincing of which is that of Allison, who maintains that the disturbance of thyroid function is derived from a chronic intestinal toxæmia.

The etiology of Graves's disease—true exophthalmic goitre—has provoked much discussion, and the most fascinating theory comes from Crile, who believes it to be a disease of the motor mechanism, which may be induced by overstimulation of the nervous system, in time causing an overproduction of thyroid secretion. To quote Crile's own words: "Graves's disease is not a disease of a single organ or the result of some fleeting cause, but is a disease of the motor mechanism of man, the same mechanism that causes physical action and that expresses the emotions; its origin is in phylogeny, and its excitation is through some stimulatory emotion, intensely or repeatedly given, or some lowering of the threshold of the nerve receptions, this establishing a pathologic interaction between the brain and the thyroid."

There is little or no speculation on the part of those writing from the Mayo Clinic as to the factors which lead up to the definite pathologic changes which uniformly occur in exophthalmic goitre. It is regarded as a form of thyrotoxicosis in which the toxin, whatever may be its nature, acts directly on the more vital organs, more notably the central nervous and vascular systems, and that the clinical picture is made more complex by the interaction of those organs, whose functions have been directly disturbed by the toxin (Plummer). The most persistent and consistent opponent of thyroid hypothesis is Marine, whose work, because of its thoroughness and exhaustiveness, is always worthy of mention. Marine (*Journal of the A. M. A.*, lx, p. 325) believes that the thyroid hyperplasia of exophthalmic goitre behaves toward iodine as does any other thyroid hyperplasia of any animal thus far investigated. He even goes so far as to say that no specific or constant changes in the thyroid of exophthalmic goitre have as yet been demonstrated, that the iodine so far as it is at present known is identical with those iodine relations given to other clinical associations, and that the thyroid of exophthalmic goitre has no different pharmacological action on animals or therapeutic on myxœdema or toxic action on patients with exophthalmic goitre than thyroid preparations of other clinical associations with like iodine contents. These statements provoked a sharp criticism from C. H. Mayo, who insisted that Marine's observations lead him to conclusions not supported by surgeons of the present day. In further controversion of Marine's theory, Plummer stated (1) that hyperplasia of the thyroid never existed without a production of thyroid secretion in excess of the demands of the individual; (2) that exophthalmic goitre is a clinical entity associated with a definite pathological process in the thyroid; (3) that if hyperplasia of the thyroid is of a sufficient degree or extends over a long enough period,

exophthalmos is almost sure to develop; (4) that no matter how intense the intoxication from an adenomatous or colloid group not associated with hyperplasia, exophthalmos will not develop.

Classification.—For a proper understanding of the goitre question, especially with relation to the indications for operation, one must be familiar with various pathologic processes and with their clinical expressions. No more beautiful and convincing example of the advantages of the closest coöperation between the clinical and pathological departments can be found than in the extraordinary accuracy with which the diagnosis and prognosis of clinical manifestations of thyroid lesions can be substantiated and foretold by the pathologist's report. The pathologist's study of the thyroid gland has proven beyond a peradventure of doubt that exophthalmic goitre is represented by certain definite essential lesions in the thyroid gland. A few years ago there was, however, some confusion as to what constituted true Graves's disease or exophthalmic goitre, and Kocher maintained, and with some justification, that American writers were not discriminating enough in their classification, in that they include all types of hyperthyroidism with their cases of the true exophthalmic type. This criticism has borne fruit in the elaborate combined pathological and clinical studies of Wilson and Plummer, who, as a result of the studies of the material from St. Mary's Hospital, have elaborated a classification which bears the closest scrutiny and satisfactorily provides for the group of doubtful cases that were neither simple nor exophthalmic goitres. This classification divides all goitres, excluding those of a purely inflammatory or malignant nature, into 4 groups:

Group I. Non-hyperplastic atoxic—the ordinary colloid goitre or adenoma.

Group II. The non-hyperplastic toxic, representing 57.2 per cent. of the total number. There are two significant facts associated with this group. First, that 23.3 per cent. of the non-hyperplastic group presented some toxic symptoms, and, second, that there was an extraordinary difference between the average age at which these non-hyperplastic-toxic goitres appeared and the hyperplastic-toxic goitres of the exophthalmic type. In the former the average age was 22 years, in the latter 32 years. A still further distinction between these two groups is the significant fact that in the non-hyperplastic-toxic group (the simple goitre and the adenoma with toxic symptoms) the evidence of intoxication did not show itself until an average age of 36.5 years, that is, 14 years after the onset of the goitre, whereas in the true

exophthalmic type, the hyperplastic-toxic, the toxic symptoms appeared on an average within a year.

Group III. The hyperplastic-toxic represented 42.8 per cent. of the total number of specimens, and of these 99.2 per cent. had toxic symptoms. To this group belong all the cases of true exophthalmic goitre.

Group IV. The hyperplastic-atoxic, comprising but 1 per cent. of the total hyperplastic specimens, may represent a slight margin of error.

This classification, which conforms with extraordinary mathematical accuracy to the clinical syndromes of goitre, should, I believe, be adopted and serve as a working basis in the elaboration of our plan of treatment. In an analysis of my own records, I find that 35.7 per cent. belonged to the non-hyperplastic-atoxic group, 31.6 per cent. to the non-hyperplastic-toxic group and 32.6 per cent. to the hyperplastic-toxic group (see Table I).

TABLE I

Pathological diagnosis	Non-hyperplastic non-toxic	Non-hyperplastic-toxic	Hyperplastic-toxic	Total
Simple	20	14	..	34
Adenoma	12	17	..	29
Carcinoma	2	..	..	2
Sarcoma	1	..	..	1
Exophthalmic	..	..	15	15
Ligation cases	..	..	17	17
Total	35	31	32	98

Symptomatology.—The clinical picture of thyrotoxicosis has been so frequently described as to permit of no amplification. The relative frequency of the various symptoms is expressed in tabular form and calls for no especial comment. Mention might be made of an unusual phenomenon in one of the series—a periodic swelling of the upper lip synchronous with exacerbations of the disease and the development of a Bell's palsy. Whether the former was the outcome of some vasomotor disturbance of sympathetic origin is an interesting question. The Bell's palsy may have been incidental or perhaps toxic.

Surgical Aspects.—With these introductory remarks, I come to the consideration of the surgical aspects of goitre and will discuss the surgeon's responsibility with reference to these various groups, and first of all with reference to the non-hyperplastic, non-toxic type. By way of preface, I think one can truthfully say that goitre may be treated by both non-surgical and surgical measures. We must remember too that in the

life history of simple goitres there are certain structural changes which take place spontaneously, perhaps physiologically, as in pregnancy and menstruation, that is, without artificial measures, during which periods the gland may increase in size temporarily only later to diminish to one of inconspicuous dimensions. We should warn the practitioner against the effect of the administration of iodine or thyroid extract, either of which may induce toxic symptoms in a hitherto benign condition, a condition which Kocher styles as "iodine Basedow," an artificial Graves's disease evoked by the administration of iodine in nervous patients affected with goitre. If the treatment is persisted in the patient may die under the same circumstances as in spontaneous Graves's disease.

TABLE II
SHOWING SYMPTOMS IN TOXIC CASES

Pathological diagnosis	Cerebral symptoms	Vasomotor disturbances	Mental irritability	Tachycardia	Tremor	Exophthalmos	Cardiac insufficiency	Loss in weight and strength	Diarrhœa	Œdema	Headache	Jaundice	Vomiting
Non-hyperplastic-toxic (simple)	1	2	10	10	9	3	10	3	1	1	2	..	..
Non-hyperplastic-toxic (adenoma)	..	8	17	17	4	..	17	6	2	2	1	1	..
Hyperplastic-toxic	..	4	15	15	6	14	10	5	6	2	2	2	2
Toxic cases in which ligation was performed	1	6	1	17	10	16	12	7	9	3	1	..	6
Total	2	20	59	59	29	33	49	21	18	8	6	3	8

When consulted by the patient with simple goitre, colloid or adenoma, as to the propriety of operation, I present the situation somewhat as follows: that the operation is peculiarly free from danger, that the patient must decide for herself whether the swelling is enough of a personal annoyance to warrant its removal, that there is a tendency in a considerable number of cases for simple goitres to undergo certain changes which will affect the heart and nervous system, and eventually lead to permanent damage of the heart, kidneys, and liver; that in exceptional instances in later life goitres become cancerous. This, to my mind, is a fair presentation of facts based not only on my own experience, but on the statistics of large groups of cases. As to the risk of operation, there were no fatalities in my own series of partial thyroidectomies; in larger series we find the mortality in 561 cases, in the Clinic of the St. Mary's Hospital in 1913, to be 0.18 per cent. Of the

chances of a thyrotoxicosis developing in simple goitres, the statistics from my clinic give a percentage of 41.1, while from the Mayo Clinic the percentage was 23. To put it in another way, one in four or one in three patients with simple goitre will develop a symptom-complex which in many respects, both as to the clinical picture and as to the gravity of the disease, is so closely analogous to true exophthalmic goitre as to be almost indistinguishable. With the exception of three or four of the true exophthalmic type, one of the most gravely sick in my entire series belonged to this group.

> The patient (file No. 14421), referred to me by Dr. A. R. Johnson, of New Bloomfield, Pa., was forty-six years of age; 14 years ago the goitre first appeared, but there were no associated symptoms until 9 years later, when she developed shortness of breath, tachycardia, palpitation, diarrhœa, loss of weight and strength, and nervousness. The patient was emaciated, extremely nervous, her heart was dilated, the pulse was most irregular, and tachycardia extreme. She was given a short course of preparatory treatment, the left lobe was removed, and the superior thyroid artery ligated on the opposite side. Apart from an attack of acute dilatation of the stomach her convalescence was uninterrupted. The histological study showed no evidences of hyperplasia, the pathological diagnosis being colloid goitre with evidence of hemorrhage into the interstitial tissue and between the glandular acini.

Finally, as to the incidence of malignant degeneration of simple goitres, this is an important phase of the subject because, when malignancy can be recognized by the physical signs, the tumor has attained the inoperable stage in most cases. In my records there were five cases of malignant disease; three of these were recognized clearly as such before the operation, and the remaining two were recognized in their incipiency only by the microscope. One of these (File No. 25777) was found in an adenoma removed from a patient thirty-six years of age, who had had a goitre since she was eighteen, and began to develop symptoms of hyperthyroidism 14 years later, for the relief of which the operation was performed. The second case (File No. 14422), referred to me by Dr. William Glosser, of Williamsport, Pa., developed a goitre at the age of twenty-one, after the birth of her child, and from that time to the present she has had some disturbance of her circulatory and nervous system. The right lobe was removed and the pathologist reported adenoma with beginning malignant degeneration. The incidence of carcinomata is, therefore, a matter which must not be overlooked in the argument for or against operation.

In discussing the selection of cases of the toxic group for operation, I will include both those of hyperplastic and those of non-hyperplastic

origin, for while the higher percentage of more serious cases will be found in the hyperplastic group, cases equally as serious but in smaller numbers will be found in the non-hyperplastic. We must assume at the outset that in most cases the toxic goitres run an essentially chronic course, to be sure with considerable variations and more or less frequent explosions, and that it has its fatal tendencies. That the mortality is high in unoperated cases is usually not appreciated by the general practitioner. In one family under my observation the elder daughter (File No. 521) developed exophthalmic goitre and the physician and consultant strongly opposed operation. She died four years later at the age of 30—death was sudden and the doctor pronounced the cause of death as "apoplexy." Two years after that her younger sister, who had symptoms of hyperthyroidism (File No. 6650), was referred to me by the same physician for operation. The lesson had been learned, though at the cost of a human life.

For the sake of convenience we may distinguish between cases of a moderate severity and those of a more serious nature. Our advice to the cases of moderate severity depends upon their financial and social status. If conditions are such as to make it impossible to undergo an adequate course of treatment with the necessary physical and mental rest and perhaps change of environment, and if it will be necessary for the patient to return immediately after her treatment to conditions of employment which would predispose to relapses, we strongly urge immediate operation. In a number of mild cases, prolonged courses of treatment under competent physicians had been ineffectual and operation had to be resorted to. There have been no deaths in this series, and the results have been almost uniformly satisfactory.

As to the cases of more grave character, our plan has been not to give an opinion until the patient has been under observation for a week with absolute rest. Many of these cases come from a distance, are fatigued by travel, and are in a state of nervous excitement at the time of the first examination. They are put to bed and the condition of the cardiovascular system carefully studied. Usually within a week the condition will improve sufficiently to justify operation, or at least to determine with greater intelligence the mode of treatment to be adopted.

What should be considered contra-indications to operation? Kocher (*Brit. Med. Jour.*, October 1, 1910) regards chronic nephritis, enlarged thymus, and glycosuria as contra-indications, and in his writings lays great emphasis upon lymphocytosis and a decrease in the polynuclear cells as an index of the gravity of the case. In the blood analysis of my cases, I have not been able to confirm this statement. The follow-

ing summary is taken from my records and, for the sake of comparison, the cases have been divided roughly into two groups, the grave and the moderate, in accordance with the clinical picture:

Highest of grave cases	55
Highest of moderate cases	38
Lowest of grave cases	15
Lowest of moderate cases	21
Average of grave cases	30.2
Average of moderate cases	27.6

From these it will be seen that the degree of lymphocytosis did not bear any constant relation to the severity of the case or to the prognosis. The condition of the myocardium has served for me as the most reliable guide.

The acute exacerbations, the explosions of hyperthyroidism, should be regarded as a positive contra-indication. A dilated heart, failure of compensation, poor muscular sounds, are the danger signals, and will determine whether operation must be deferred or altogether abandoned. Had I recognized this condition and observed this stricture, I would not have operated when I did on one of my two fatal cases.

The patient (File No. 10286) was forty years of age, the symptoms were only of six months' duration, the heart action was extremely irregular (delirium cordis) and the heart dilated, tachycardia was marked, the vessels of the neck pulsating, restlessness extreme, the urine contained albumin and granular casts, the legs were œdematous, and there was some ascites; the hæmoglobin was 75 per cent. and there was a lymphocytosis of 27; respirations were rapid, and the thymus gland was enlarged. This was a case running an acute course, with a dilated heart, failure of compensation, chronic nephritis and an enlarged thymus. Both superior thyroid arteries were ligated under local anæsthesia preceded by scopolamine and morphine; the patient died 5 hours after the operation. This happened two years ago. To-day, the operation, if performed at all, would have been deferred until the patient's condition had improved, one instead of two vessels would have been ligated, nitrous oxide anæsthesia would have supplanted local, and anoci-association would have been included in the preparation.

In the non-toxic varieties, our technic comprises the Kocher collar incision, separation in the midline of the sternohyoid and thyroid muscles, the high division of one pair or the other, if necessary, the removal of one or one and a part of another, always leaving the posterior capsule *in situ* to avoid removal of the parathyroid glandules (subcapsular lobectomy). The muscular layers including the platysma are closed with interrupted catgut sutures, and the skin with horsehair.

Drainage is the rule. In the toxic variety, the patients are admitted to the hospital with the understanding that if an operation seems advisable full consent is given to perform it at such time as the surgeon thinks best. Thereafter the subject of operation is never discussed in the presence of the patient or nurses; the patient is put to bed immediately, given seven minims of tincture of belladonna t. i. d., and an ice-bag applied to the neck or precordium and the formula for stealing the gland according to Crile's technic adhered to closely. This includes a rectal irrigation at 7.30 A.M. daily, a hypodermic of sterile water at 8 A.M., an "inhalation treatment" at 9 A.M. by the anæsthetist, and breakfast at 9.30. On the morning of the operation, an enema is given at 7.30 A.M., scopolamine gr. 1/200 at 8, morphia sulphate gr. 1/6 at 8.45, and at 9 the anæsthetist begins with the inhalation treatment and substitutes nitrous oxide, under the influence of which the patient is brought to the operating room.

I am thoroughly convinced of the advantages of anoci-association, although my practice of it is limited to the avoidance of harmful psychic stimuli before the operation. The infiltration of the wound with cocaine, quinine, and urea has seemed to complicate wound repair, and I believe can be dispensed with as relatively unimportant. At least since I have abandoned it the immediate results have been equally good, and the cosmetic effect better. While the elimination of harmful psychic excitation should be taken into consideration, is it not true that after the patient's confidence is thoroughly won, the mere thought of operation begins to lose its terror and thus the surgeon's personality counts as a factor in the working out of anoci-association? In one case I tested out the patient before the operation (File No. 24984). The superior thyroids and one inferior thyroid had been ligated at two sittings at intervals of several months. On her third admission the patient was sent for in the course of the morning clinic; I discussed the treatment in her presence before a group of students, told them what had been done for her, how much she had been improved, that further treatment would be required. The patient, during the months of her struggle for health, had come to place implicit confidence in me. I watched her carefully during this discussion and observed that she was comparatively calm and that her pulse was not accelerated by the ordeal. When asked whether she would like us to go on with the next stage of treatment, she expressed her readiness, climbed on the operating table, and I at once removed one lobe under nitrous oxide anæsthesia. She has finally recovered her health, and when last seen her pulse was 68 on sitting and only 80 after exertion—a complete transformation from

her former debilitated state. This is an example of what I mean by the application of psychic influence in the treatment of Graves's disease, which unquestionably is a factor of great importance.

With reference to the advantages of scopolamine in all cases, I have been a little skeptical. At least in some cases it seemed to have a disturbing rather than sedative action. In two cases particularly the pulse was accelerated, and the patients became extremely restless and in one instance delirious. In this case, the operation was postponed because of this extreme excitation; at the time set for the operation two weeks later the scopolamine was omitted and this condition of excitation did not occur. In most of the toxic cases and in all the more serious ones, nitrous oxide anæsthesia has been used, and I believe to advantage. The choice of operation must be left to the individual judgment of the surgeon. My rule has been to err always in favor of conservatism, to choose in doubtful cases ligation rather than lobectomy, one vessel rather than two, or in the more serious cases injection of boiling water rather than ligation. While I have had no experience with the latter I am convinced from the reports of Porter (*Jour. Mich. State Soc.*, February, 1913) of its usefulness. The only two cases which died in the hospital as the result of operation were double ligation, and in looking over the records, I can clearly see the wisdom of substituting boiling water injections at least as a preliminary treatment for ligation. I have practised ligation 17 times in 14 patients. In 9 both superior arteries were ligated, in 3 the right superior, in 4 the left superior, and in 1 the left inferior. Five patients were operated upon twice and one three times, as follows:

First operation	Second operation	Third operation
1. Ligation right superior thyroid	Lobectomy.	
2. Right lobectomy	Ligation left superior thyroid.	
3. Ligation both superior thyroids	Ligation left inferior thyroid	Right lobectomy.
4. Ligation both superior thyroids	Right lobectomy and ligation of left superior pole.	
5. Ligation right superior thyroid	Ligation of left superior thyroid.	
6. Ligation of both superior thyroids	Right lobectomy and ligation of left superior pole.	

Halsted's (*Trans. Am. Surg. Assn.*, 1913) preference of ligation of the inferior over the superior thyroid artery deserves consideration, and while from the purely technical consideration and the cosmetic effects he has made out a strong case in favor of the inferior thyroid, I still favor the superior thyroid, because of the greater facility of including in the ligature not only the vessels but the nerves, a technical point of which Crile has explained the importance.

Results.—Of the 103 operations, there were 80 thyroidectomies with no deaths. Of 3 thyroidectomies for malignant disease, there was one death, a sarcoma in a boy eleven years of age. Of the 17 ligations, there were two deaths, both true exophthalmic goitres, one an acute case of six months' duration already referred to, the other a case in the terminal stage of the disease.

TABLE III

FINAL RESULTS IN 37 CASES PRESENTING TOXIC SYMPTOMS WHICH HAVE BEEN RECENTLY HEARD FROM

Pathological diagnosis	Entirely well	Greatly improved	Moderately improved	No improvement	Total
Non-hyperplastic-toxic (simple)	2	1	2	..	5
Non-hyperplastic-toxic (adenoma)	5	5	2	..	12
Hyperplastic toxic	5	7	1	..	13
Toxic cases in which ligation was performed	3	3	1	..	7
Total	15	16	6	..	37

TABLE IV

SYMPTOMS IMPROVED SINCE OPERATION IN 30 CASES RECENTLY HEARD FROM

Pathological diagnosis	Mental irritability	Palpitation	Ocular disturbance	Weight	Strength	Diarrhœa	Dyspnœa
Non-hyperplastic-toxic (simple)	4	2	..	4	4	..	3
Non-hyperplastic-toxic (adenoma)	9	9	1	7	7	..	2
Hyperplastic-toxic	11	9	10	10	10	4	7
Toxic cases in which ligation was performed	4	3	4	4	4	4	3
Total	28	23	15	25	25	8	15

The end results in the toxic cases were in accordance with those recorded from other clinics. Of the patients heard from, 90 per cent. had fully recovered or were greatly improved and of the latter a number had been operated upon within the last year. The complete-

ness of the cure does not depend entirely upon the successful removal of the gland. Two other factors must be considered: first, the care of the patients after the operation which should, whenever possible, free the patient from physical and nervous strain for periods varying from several months to two years. Unfortunately, the social status of the patient may make it impossible to provide these conditions sometimes. This must be borne in mind by the practitioner into whose hands the patient falls after operation, and the completeness of the recovery will depend upon his appreciation of the need of this after-treatment and whether the circumstances permit of its enforcement. Second, the existence of chronic visceral disease at the time of the operation must be taken into account. Some of these patients are physical wrecks with organic lesions of heart, kidney, and other organs, from which complete recovery is impossible. As Kocher (*Brit. Med. Jour.*, February 17, 1912) has said, if all cases were operated upon within a short time after the outbreak of the disease, they would probably all be cured and to this might be added that the mortality, low as it now is in all cases, would be reduced to that of as common a procedure as herniorrhaphy.

The general practitioner has every right, if he so chooses, to try nonsurgical means in the early stages of the disease before the myocardium or kidney or nervous system is permanently damaged. But if he fails to arrest the disease and does not advise operation in the curable stage, he should be just as severely censured as the practitioner who fails to call for surgical aid until his patient with acute appendicitis has developed peritonitis, or one with a callous ulcer of the stomach, carcinoma. The conditions are quite parallel. The extraordinary recuperative power of patients with Graves's disease is amazing, and in most cases, sick as they are at the time of operation, they will almost uniformly be restored to perfect or reasonably good health.

Dr. George P. Müller believed that too much emphasis is laid upon the preliminary medical treatment of exophthalmic goitre by most of the writers and text-books on the subject. It seemed to him that those cases seen early, before the so-called four cardinal symptoms are present, when mental irritability, general nervousness, loss of weight and strength and tachycardia may be the chief evidences of hyperthyroidism, may be completely cured by non-operative measures, of which rest is the key-note of treatment. In cases in which the diagnosis is established, it is an absolute waste of time in trying the so-called medical treatment for the three or four months advised by most writers.

STATED MEETING, HELD MAY 4, 1914.

Dr. G. G. Ross in the Chair

UNUNITED FRACTURE OF THE NECK OF THE FEMUR, TREATED BY BONE-TRANSPLANT

Dr. Astley P. C. Ashhurst presented a man, thirty years old, who in August, 1913 (seven months after injury), came under his care at the Orthopædic Hospital, in Dr. Harte's service, and was found to have an ununited fracture of the neck of the right femur. He was unable to walk without crutches, on account of pain and weakness; he could stand alone, and even bear momentarily all his weight on the injured limb, but the hip grated, and the trochanter slid up and down on the pelvis. There was shortening of an inch and three-quarters. A skiagraph showed an ununited fracture at the base of the neck, oblique, and the longer fragment belonging to the head of the bone and the front of the neck (Fig. 1).

The patient was referred to the Episcopal Hospital (there being no vacant bed at the Orthopædic Hospital), and admitted to Dr. Frazier's service. Operation was done by Dr. Ashhurst on August 22, 1913.

1. An incision was made downward for 3½ inches from the anterior superior spine of the ilium, passing between the sartorius and tensor fasciæ femoris, and then between the ilio-psoas and rectus muscles. The capsule of the hip joint was then opened and detached widely from the anterior intertrochanteric line, exposing the line of fracture, which was bevelled at the expense of the posterior surface of the neck, and extended anteriorly to the extracapsular region of the great trochanter. Only fibrous union was present, and the fragments were easily pried apart with a bone elevator. The fractured surfaces were then freshened. It was now found that by outward rotation, followed by longitudinal traction and finally by inward rotation, the fragments were jammed together in good position. The wound was then temporarily packed with gauze.

2. A bone peg (Fig. 2) was removed from the crest of the left tibia by means of the speaker's circular saw (Fig. 3); the dimensions of this peg were four and a half inches long, and one-half by three-eighths by three-eighths of an inch thick (11.5 cm. long, and 1.5 cm. by

1 cm. by 1 cm. thick); it tapered slightly at its lower end. This bone peg was temporarily put in hot salt solution, and the leg wound closed.

3. The fracture of the cervix femoris was set under control of direct vision, by outward rotation, longitudinal traction, and finally inward rotation. While the limb was securely held in this position, an incision one and a half inches long was made over the great trochanter, and by means of a steel drill in a hand-driven brace (Fig. 3) a hole was bored through the trochanter and neck into the head. First a drill three-eighths of an inch in diameter was used, then one fifteen-thirty-seconds of an inch in diameter; and as the peg proved too large to be driven in through this hole, a drill half an inch in diameter was finally used. The peg fitted this hole very snugly, and it was necessary to drive it home with very vigorous blows from the mallet (Fig. 4). Some of the projecting end of the peg was then cut off. The two wounds in the hip were then closed, and the limb dressed in plaster of Paris from toes to axilla, in an abducted position. The time of the entire operation, including plaster of Paris, was two hours.

September 22, 1913: One month after operation, the plaster case was removed below the knee.

October 12, 1913: Seven weeks after operation the remainder of the plaster case was removed. There was no stiffness or thickening around the hip joint, and the incisions were healed. The end of the bone peg was palpable beneath the skin over the great trochanter. There was no shortening of the limb and no movement between the fractured surfaces. Rotation at the hip was normal. Flexion to 150 degrees was easy and painless. The patient was to stay in bed two weeks longer.

October 20, 1913: Allowed to be up in wheel-chair.

October 25, 1913: Walking with crutches and a high shoe on the left foot, preventing any weight-bearing on the fractured limb.

November 27, 1913: Discharged from the ward, with directions to bear no weight on the right foot until six months after operation. A skiagraph made about this date showed the same conditions as Fig. 4. Figs. 5 and 6 are from photographs made December 1, 1913, four months and a half after operation.

Soon after this time the patient returned to his home in Ohio. About the first of the year (over four months after operation) he was permitted to abandon the use of the high shoe, but was directed to continue the use of crutches. This, however, he did not do. He felt so well and strong, he wrote, that as soon as he gave up using the high shoe he threw away his crutches. The effect of this was apparent when

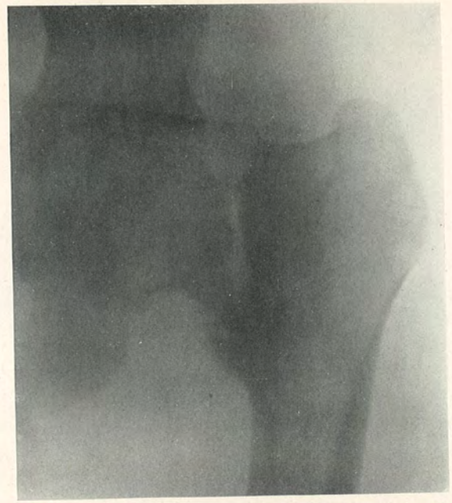


FIG. 1.—Ununited fracture of cervix femoris, seven months after injury. Unable to walk without crutches.

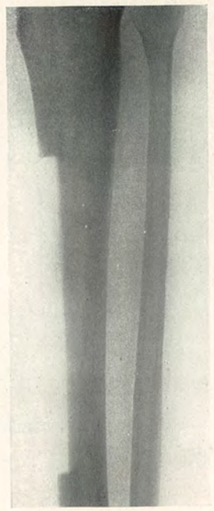


FIG. 2.—Showing defect in tibia after removal of bone peg.

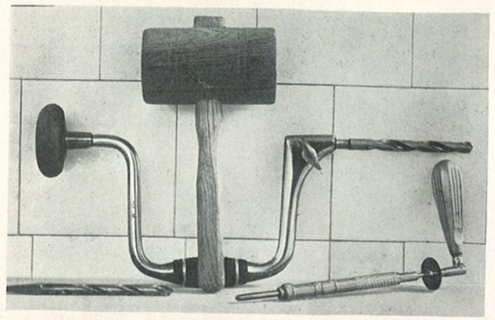


FIG. 3.—Circular saw, brace, drills and mallet used in transplanting a bone peg for ununited fracture of neck of femur.

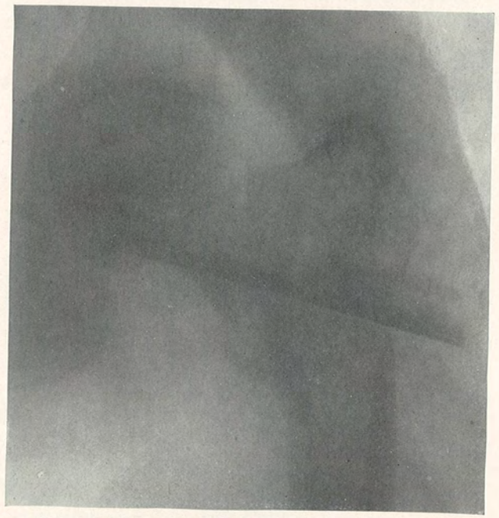


FIG. 4.—Bone peg in ununited fracture of cervix femoris (skiagraph made through plaster-of-Paris dressing 10 days after operation).

FIG. 5.

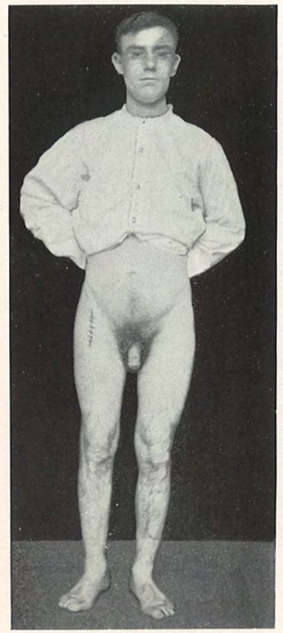
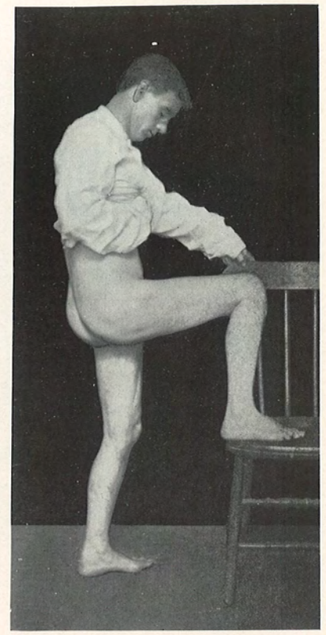


FIG. 6.



FIGS. 5 and 6.—Bone peg implanted in neck of femur for ununited fracture. No shortening, free motions, four months and a half after operation.

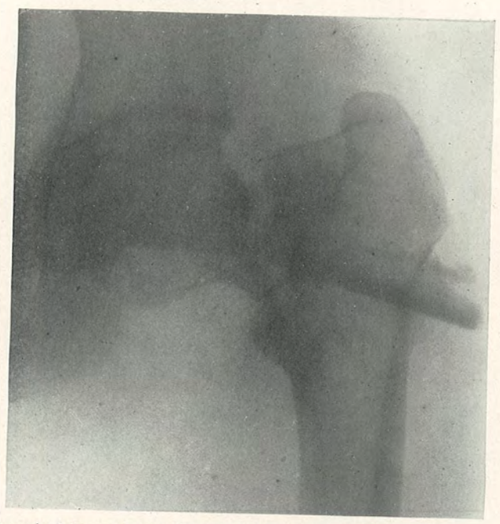


FIG. 7.—Skiagraph eight months after insertion of bone transplant, showing incomplete fracture of the transplant and secondary coxa vara.

he next presented himself for observation on April 20, 1914. He was now wearing a lift in his right heel, as he felt the limb was shorter than the left. Measurements showed a shortening of half an inch; in December, 1913, there had been no shortening. Otherwise the hip was in good shape: there was flexion to about 70 degrees, free rotation, abduction through about 10 degrees, and all these motions were painless. Walking was easy without any support, but there was a noticeable limp; the man had not been able to return to his usual occupation in the pottery, as this involved heavy lifting, and his employers were unwilling to risk an accident though the man himself said he was sure he could do the work. Meanwhile he had been doing odd jobs, but he had no steady employment. His chief complaint was of pain above the knee, worse after resting. When his knee gets limbered up he walks with very little limp.

A skiagraph was taken (Fig. 7), and this promptly revealed the cause of the shortening; the transplant had fractured, and the resulting coxa vara prevented as free abduction as had been present before the patient resumed weight-bearing on the limb. In spite of the fracture of the transplant, the fragments seemed to be firmly united, though little callus is visible in the skiagraph. It is interesting to see that the end of the bone peg projecting beyond the trochanter is gradually being absorbed. In Albee's similar case, of which an illustration is given in Murphy's Clinics (June, 1913, Fig. 98), it is stated that the skiagraph (five weeks after operation) shows proliferation of bone from the protruding end of the bone peg. In the skiagraph of the present patient there is apparent quite a growth of bone on the surface of the femur around the drill hole, but this, I believe, is due to extension from the femoral shaft and not due to growth in the transplant. Dr. Albee always preserves the periosteum in his transplants, and Dr. Murphy does likewise, but in Dr. Ashhurst's operations he has always removed the transplant subperiosteally, regarding the periosteum simply as a limiting membrane. McWilliams, however (*Jour. Amer. Med. Assoc.*, 1914, i, 346), has reported very careful experiments, in which he comes to the conclusion that it is very important to preserve the periosteum because it renders the transplant more easily permeable by surrounding capillaries, thus ensuring the early establishment of an adequate circulation through it. His experiments certainly show the value of preserving the periosteum, since in a number of instances he secured reproduction of bone from periosteum alone; but there may be another reason than that given by Dr. McWilliams for the greater liability of the bone graft to be absorbed when it is uncovered by peri-

osteum. This may very well be that the periosteum really acts only as a limiting membrane, and *protects the transplant from solution by the cells of the surrounding tissues.* When the transplant is *embedded within osseous tissue,* as is the case in the transplant figured in the accompanying illustrations, and in the transplants used for splinting the tuberculous spine, there is apparently little fear of its absorption; when, on the other hand, it is embedded, not in osseous tissue but in the soft tissues, it is very likely to be absorbed unless protected from solution by an envelope of periosteum, its *normal limiting membrane.* Thus it is not surprising to see in Fig. 7 that the end of the bone peg projecting beyond the femur is being absorbed, while that embedded within bone, or in immediate contact with living bone, preserves its form unaltered. It will be interesting to know what became of the end of Albee's transplant eight months or more after operation. J. B. Murphy has reported one case (Murphy's Clinics, October, 1913, vol. ii, p. 797) in which he thought the preservation of the periosteum was detrimental to the production of new bone, but unfortunately the stenographic report of his remarks is so inaccurate that it is imposible to know just what was done: the skiagraphs he presents indicate that a subperiosteal resection of the upper end of the humerus was done for cystic osteitis, and that in the place of the diseased humerus (removed subperiosteally) a transplant was inserted which had its own periosteum still in place. The subsequent skiagraphs (Figs. 200–204) indicate that the transplant with its periosteum was then surrounded by new bone formed between the transplant and the ensheathing periosteum which belonged to the excised humerus, and Dr. Murphy states that the periosteum which belonged to the transplant acted detrimentally in that even as long as seven months after operation it remained as a white line (visible in the skiagraph) between the transplant and the surrounding new-formed bone. But though all the skiagraphs clearly indicate that this new-formed surrounding bone developed beneath the original periosteum of the (subperiosteally) excised humerus, it is stated in the text of Murphy's Clinics (p. 788) that the periosteum was excised along with the diseased humerus.

Although the patient presented has been walking on his leg without any support from crutch or cane for a period of four months, it is scarcely possible to reckon his present condition as an end-result. He has not returned yet to his ordinary work, but there seems every likelihood of his being able to do so within a short time.

Finally, Dr. Ashhurst suggested that bone transplantation is a better method of treating ununited fractures of the hip than the use of nails,

screws, etc. But, as the present case demonstrated, it is not safe for the patient to bear weight on the limb as soon as four and a half months after operation. This patient did so contrary to advice, and as a consequence he fractured the transplant.

In an interesting paper on the subject of intracapsular fractures of the hip, read before this Academy two years ago by Dr. G. G. Davis (*Trans. Phila. Acad. of Surg.,* 1913, xv, 112), the following were among the conclusions reached:

"The surest way of remedying cases of ununited fracture of the neck of the femur is to cut down, freshen the edges of the fragments, pin them together with screws, nails, or other means, and put them up in the abducted position. When foreign bodies are inserted to pin the fragments together they are likely to cause discomfort sufficient to necessitate their removal. Considerable discomfort follows the operation and the patient is inclined to attribute this to the nail or screw and demand its removal. Firm union can be obtained by freshening the surfaces of the fragments and then jamming them together by widely abducting the limb and fixing it in plaster of Paris without the use of any nails, screws, or other fixation appliances."

These conclusions of Dr. Davis, who has had more experience than any other Fellow of the Academy with operations for ununited fractures of the hip, were reached before the operation of bone transplantation came into general use; and it seems that this is a better method of fixation than the use of foreign material such as nails, screws, or even ivory pegs; and that some form of direct fixation of the fragments is extremely desirable, though it had been shown by Dr. Davis that in some cases it was possible to secure firm bony union without direct fixation.

Dr. J. T. Rugh said that last fall he made bone-grafting for ununited fracture of the neck of the femur in the case of a woman forty-three years of age, who had suffered a fracture two years before. Two years ago, he put in a silver wire nail, which remained in place until the second operation. At the time that he put in the nail, after freshening the edges, he was surprised at the softness of the bone in the upper end of the femur. The nail was driven in with the greatest possible ease, so that the bone was evidently partially degenerated, and at the end of two years while the nail was in place, there was no attempt at union. She could walk slightly on the part, but a slight upward dislocation had taken place. Last October he again operated, took out the nail and enlarged the hole the nail had made, but even the bone structure in her tibia was so soft that when he attempted to drive the graft into the hole in the neck of the femur, the graft itself broke down like very soft

wood, so that her bone structures all over her body were decidedly poor. This taught him that not all cases of ununited fracture are amenable to treatment by this method, because of the condition of the bone in the individual.

Dr. Gwilym G. Davis said that if the patient has good enough bone to make a transplant the question of using the transplant as a peg promises to solve the question as to what means shall be used to fix the fragments. He remembered the trouble experienced in using pegs or pins of steel and screws—for instance, one of his cases simply complained of pain although the wound was long healed, tightly and apparently satisfactorily. The patient knew the steel was in there and he could not get the idea out of his head that it should come out. At last he found a doctor who tried to take it out but he could not find it, and simply left a nasty sinus through which later Dr. Davis had to take out the screw—no matter what foreign body is put in, the surgeon is liable to hear from the patient sooner or later. This case just cited occurred before the suggestion was made by Albee of using a bone pin.

Dr. Duncan L. Despard inquired whether Dr. Ashhurst felt that a bone peg is a distinct advance over the silver nail in fracture of the neck of the femur? In the last three years he had attempted this operation in 3 cases, all patients older than his, the youngest being fifty-four years of age. In each of these cases at the time of operation there had been a tremendous amount of absorption of the head of the bone, and he practically had no hope of bony union and only tried for an ankylosis. He did not think any results in his cases had been very much of an improvement. They walk with decided limps. It is a question whether the bone peg offers very much more than the silver nail. It does not stand as much strain as the nail, and the difficulty of keeping the patient quiet for the long period of time required is not to be overlooked.

Dr. Ashhurst, in response to Dr. Despard's query, called attention to the remark of Dr. Davis that bone pegs should be an advantage over foreign bodies because the patient is not satisfied to allow foreign substances to remain. If the patient has only his own bone it is reasonable to suppose his mind will be relieved. This bone is either an absorbable foreign body or else remains as bone. It will promote osteogenesis and so procure firm union.

CINEMATOPLASTIC AMPUTATIONS

By Astley Paston Cooper Ashhurst, M.D.
of Philadelphia
associate surgeon to the episcopal hospital; instructor in surgery in the university of pennsylvania

It does not appear that amputation for cinematic prosthesis, according to the method of Vanghetti,[1] has received adequate attention in this country. This emboldens me to report two cases in which I have resorted to this procedure, though the report is necessarily incomplete as it has not yet been possible to secure a satisfactory prosthesis, though the patients have good motion in their stumps.

The design of the operation, briefly, is to construct one or more muscular or tendinous loops at the end of the patient's stump, so that the voluntary movements of these loops may be transmitted to the artificial hand. Many artificial arms are already on the market for use with ordinary stumps. In the case of one of those in most general use, the hand is opened by touching a spring with the other hand, and snaps shut again, into a fist, when the spring is released. Such a hand as this, as the manufacturers themselves are forced to admit, is useful for nothing more than "Sunday wear," as there is no voluntary grasp in the hand. A better type of artificial hand is one that secures its motion chiefly by means of straps passed around the patient's body, especially over the opposite shoulder. With one type of arm constructed on this principle, the patient is enabled, presumably only after long and constant practice, to perform almost any motion; and a patient with both arms amputated can dress himself, feed himself, and can make many graceful gyratory motions of little practical use. At the recent meeting of the International Surgical Society in New York City, opportunity was afforded to see a number of patients equipped with arms of this type; but on closer examination I found that while almost any motion was possible, with fingers, thumb, wrist and elbow, yet the grip was very weak (unless the hand was locked by a spring), so that no manual work was attempted. These men make their living advertising this particular make of artificial arm, as travelling salesmen; and probably could make as good a living with-

[1] G. Vanghetti: Plastica e Protesi Cinematiche; Nuova Teoria sulle Amputazione e sulla Protesi. Empoli, 1906. Previous works by this author, on the same subject, had been published in 1898, 1899, and 1900.

out any artificial arm if they advertised some other article of merchandise.

But there are very many patients in the laboring classes who are unable to live by their brains, and are utterly incapacitated by the loss of an arm; the most they can do is to act as watchmen, gate-keepers, elevator men, etc. If, however, they could be provided with a hand movable at will and possessing at the same time a grip strong enough to wield

"a shovel, a rake, or a hoe,
a pickaxe or a bill"

or do other laboring, carpentering, masonry or painting work, their earning capacity would be considerably increased, even if it still fell short of the normal.

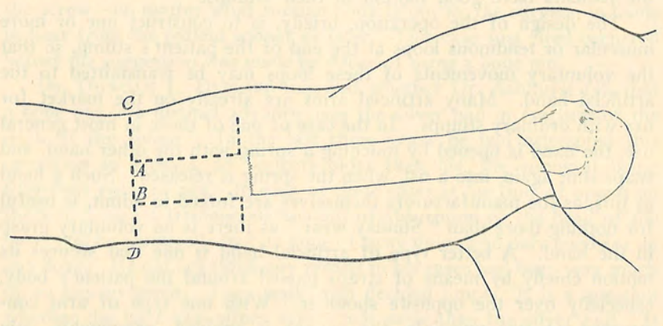


FIG. 1.—Cinematoplastic amputation. Inner surface of arm; the flap, *AB*, is to be used to cover the end of the bone; circular amputation at *CD*.

The amputation for cinematic prosthesis is a tedious operation and is not designed as a primary procedure in traumatic cases or in other patients acutely ill. The primary amputation in such cases should be given ample time to heal before the cinematoplastic amputation is undertaken. The level of bone section is determined by the length of the soft parts available for making the muscular loops; the latter should be amply long, so as to allow for subsequent retraction and nevertheless provide for plenty of play beyond the bone end.

In both the cases in which I have adopted this method, the amputation was done through the humerus, by the following technic (Figs. 1–4), which differs somewhat from that described by Vanghetti: a small skin flap is outlined over the brachial vessels, as long as the diameter of the limb and nearly an inch wide, with its base at the level proposed for section of the bone (Fig. 1, *AB*); this flap is raised with the subcutaneous tissues, and the brachial artery and vein are ligated and divided just above the level at which the bone is to be sawed. The nerves are divided at the same level or higher, but great care is exercised throughout the operation not to interfere with the nerve supply of the muscles which it is proposed to utilize in the stump. A longitudinal incision is then made on the outer side of the arm (Fig. 2), between the flexor and extensor muscles, and these with the overlying skin are then raised from the bone, from the level of proposed bone section down as far as possible. In the arm the musculo-spiral nerve is now divided, unless it was accessible from the first incision. The soft parts are then divided circularly down to the bone

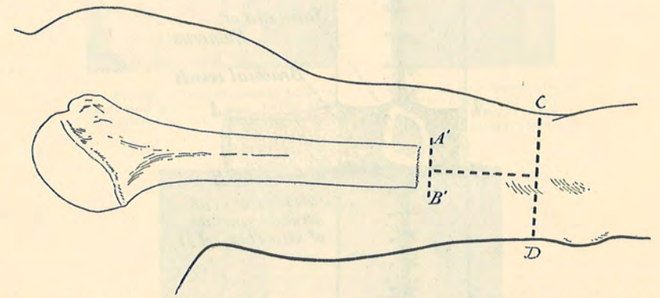


FIG. 2.—Cinematoplastic amputation. Outer surface of arm; the flap, *AB*, is sutured to the line *A'B'*.

at the distal limit of healthy tissues, and the musculo-cutaneous flaps are raised; the anterior flap contains the biceps (perhaps also some of the deltoid, brachialis anticus, or coracobrachialis, according to the level), and the posterior flap contains the triceps. The bone is then sawed at the desired level. A small transverse incision is then made towards the centre of the flexor and extensor flaps through the skin only, at their bases (Fig. 1), so as to permit of wrapping the skin around the biceps and triceps respectively, in the form of a cylinder. This little procedure when repeated on the outer side of the stump also leaves a free skin margin (Fig. 2, *A'B'*) to which may be sutured the end of the skin flap designed to cover the bone. This flap is next adjusted across the end of the bone, and is sutured in place with chromic catgut (Fig. 3, *AB* is sutured to *A'B'*). Absolute hæmostasis is important. Then the skin overlying the muscular flaps is wrapped around them in a cylinder, so

far as is possible (the skin usually is too scanty, and I had to sacrifice some of the muscle in both cases), and is sutured. Next, the free ends of the biceps and triceps are sutured to each other, end on, with buried sutures of chromic gut, and the remainder of the skin is finally closed as accurately as possible. A large rubber tube is passed through the loop thus constructed (Fig. 4), and the stump is lightly dressed.

CASE I.—Man aged thirty-five, a steam-fitter by occupation, was in Dr. Frazier's service at the Episcopal Hospital. Amputation was done, August 14, 1911, at the middle of the humerus

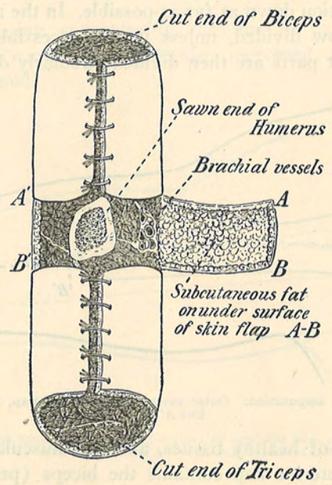


FIG. 3.—Cinematoplastic amputation. Diagrammatic view of the end of the stump. The flap, *AB* is sutured to *A'B'*, and the skin overlying the muscular flaps is sutured around them as a cylinder.

for incurable infection of the hand and forearm, of nearly four months' duration. In this case the cinematoplastic amputation was done as the primary procedure. There was prolonged but not very active suppuration, due chiefly to an intractable dermatitis of the stump, which did not heal permanently until four months after operation. Fig. 5 shows his condition four weeks after operation.

As soon as healing was complete he left the city, and I did not see him for almost two years. In November, 1913, he returned to Philadelphia and I found his stump in very good condition. The flaps had retracted considerably, and the loop is now

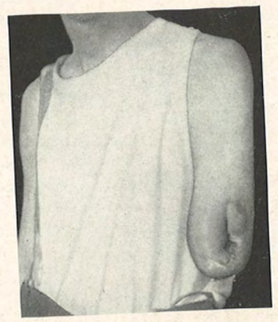


FIG. 5.—Cinematoplastic amputation: first patient; four weeks after operation.

FIG. 6.—Cinematoplastic amputation; second patient; five months after operation.

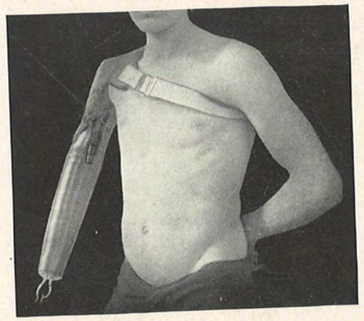


FIG. 7.—Cinematoplastic amputation; second patient; temporary prosthesis.

about one-third smaller than shown in the photograph taken four weeks after operation. His stump is strong and freely movable voluntarily over the end of the humerus, and there is a direct pull of at least half an inch (1.25 cm.). He has surprising strength in the muscular loop, and if fitted with a proper prosthesis should have a strong grip in the artificial hand.

CASE II.—Young man of twenty-one years, a painter by trade, whose arm had been amputated first for a crush at the age of fourteen years, at about the middle of the humerus. When nineteen years of age (in 1910) re-amputation had been done for a conical stump, the bone being divided this time through the insertion of the deltoid. Though this left a very short stump, it seemed that a cinematoplastic amputation should increase its

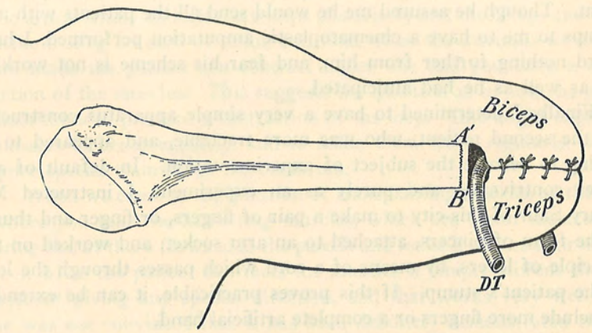


FIG. 4.—Cinematoplastic amputation. The biceps has been sutured to the triceps, and a rubber tube is passed through the loop before dressing the stump.

usefulness. The operation was done in Dr. Frazier's service at the Episcopal Hospital, on October 18, 1912. Healing was prompt and good power was secured in the stump, with nearly one inch of direct pull. The patient himself claims at least an inch and a quarter (3 cm.,) but I think this is an exaggeration. Fig. 6 is from a photograph made five months after operation.

This patient also was lost sight of for a long time, and only recently has he returned for observation. He has spent some time in jail, has neglected his stump, and thought the loop had closed up; but a strip of gauze was easily drawn through, though it caused a little bleeding, and a very slight discharge persisted as long as the gauze was kept in place. The stump is very strong, however, and the loop can be both flexed and extended very actively.

I myself and the patients themselves have consulted several manufacturers of artificial arms, with the object of having a cinematic prosthesis applied. The manufacturers invariably recommend and prefer artificial arms of their own manufacture and decline to manifest any enthusiasm about making artificial arms with a different mechanism. Finally I induced one manufacturer to make the attempt, but the patient then in question declined to pay for any "experimental" arm unless it proved absolutely satisfactory. This guarantee the maker declined to give, and the proposed deal fell through. This patient (Case I) then conceived the idea of making his fortune by inventing an artificial hand for himself, having it patented, then inducing some manufacturer to put it on the market and pay the royalties to him, while he himself would enjoy life travelling over the world as a sales-agent. Though he assured me he would send all the patients with arm stumps to me to have a cinematoplastic amputation performed, I have heard nothing further from him, and fear his scheme is not working out as well as he had anticipated.

Finally I determined to have a very simple apparatus constructed for the second patient, who was more tractable, and appeared to be willing to become the subject of experimentation. In default of any better contrivance, and purely as an experiment, I instructed Mr. Henry Saur of this city to make a pair of fingers, or finger and thumb in the form of pincers, attached to an arm socket, and worked on the principle of levers, by means of a cord which passes through the loop in the patient's stump. If this proves practicable, it can be extended to include more fingers or a complete artificial hand.

I may add that Vanghetti himself experienced very great difficulty in having a suitable prosthesis constructed, and the fact that he succeeded at last probably is due to his having as great a genius for mechanics as for surgery. However this may be, the various designs of apparatus which he gives in his book have not served to inspire any useful ideas in the mechanicians to whom I have submitted them. Hence I make this report of these amputations for cinematic prosthesis merely to show that the construction of the cinematoplastic stump is quite possible, and in the hope that someone with more mechanical ability than I myself possess will undertake the further problem of designing the prosthesis.

Dr. Gwilym G. Davis remarked that it seemed to him that there was a field for this type of amputation and he thought that surgeons would be more careful in the way that they do amputations and operate more from the utilitarian standpoint. For instance, in the lower extremity the adaptation of an artificial limb is often interfered with by the lateral protrusion of the bones in the knee-joint and ankle-joint. If such a person wishes an artificial appliance around the foot, anything placed over this protrusion increases the width of the ankle so much that it gives the impression of a marked deformity, which is of course very objectionable. That can be obviated by making the section above the ankle and getting rid of the swell of the ankle, so that when one adds the apparatus in addition to the natural stump it makes a diameter equal to the normal ankle. The operation suggested by Dr. Ashhurst is along the same lines. It is interesting that in these particular cases the biceps was united to the triceps. The biceps flexes and the triceps extends. Look at the field this opens. All we have to do is to divide the arm laterally and lift the triceps posteriorly and the biceps anteriorly, make a sling on each of them, and then when the attempts to contract are made the patient can contract either one and you have a double action of the muscles. This suggests the question as to how the patient must think to produce a contraction of the loop. One might expect the muscles to act irregularly, and to make them work regularly will require special training of the cerebrum.

When we come to the question of transplanting muscles of the knee, where you take the hamstring muscles, which are flexor muscles, and bring one of these forward to the patella and make it an extensor muscle, then when the patient contracts the muscles it simply stiffens the limb without giving any special direction, and that works very well. But he was not convinced that it has been definitely demonstrated that we can, within a reasonable time, take a flexor muscle and deliberately sandwich it in among the extensor muscles and expect it to act contrary to its original method.

RETENTION CYSTS OF THE PANCREAS

By John Speese, M.D.
of Philadelphia, Pa.

The patient, a male aged fifty-nine, was admitted to the University Hospital complaining of pain in the upper abdominal region. He states that he noted a feeling of discomfort in the epigastrium six years ago, and at times suffered from pain which radiated from the epigastrium to the lower dorsal region. Coincident with the discomfort, he experienced a sensation of pulsation in the upper portion of the abdomen, and several months ago was able to palpate a mass in the midline above the umbilicus, in the situation where the pulsation was present. The mass would disappear for a time, then reappear, and of late has been present only in the standing posture. He has lost about six pounds in weight and has had several attacks of jaundice.

The patient is married, a laborer by occupation, does not use alcohol or tobacco, his appetite has always been good, there has been no discomfort after eating.

The physical examination shows in the epigastrium a pulsating mass which seems to blend with the abdominal aorta. There is no tenderness or rigidity.

Gastric analysis: Free HCl, 0; total acidity, 20; trace of lactic acid; occult blood, 0. The microscopic examination shows much mucus, starch granules and a few Oppler-Boas bacilli.

Urine examination was negative.

Blood: Hæmoglobin, 60; red blood-cells, 3,800,000; white blood-cells, 9900.

Operation (by Dr. Frazier).—A right rectus incision was made and on examination the stomach, duodenum and gall-bladder were found to be normal. In the folds of the gastrohepatic omentum a cystic tumor was found, the contour was irregular and the mass was about the size of a large peach. On the posterior aspect it seemed to be in relation with the vena cava and adherent to the head of the pancreas, so that in removing it a thin layer of pancreatic tissue was carried away with the tumor. The rent left in the gastrohepatic omentum was closed with a purse-string suture, leaving a small opening for a drainage tube.

The patient made an uninterrupted recovery and was discharged cured.

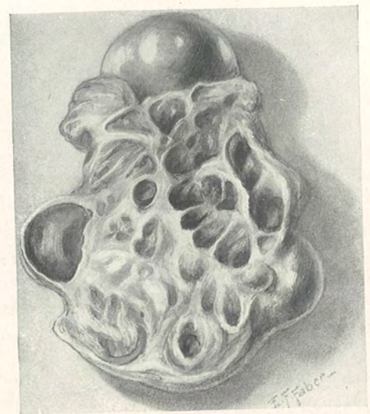


Fig. 1.—Retention cysts of the pancreas.

Fig. 1.—Retention cysts of the pancreas.

Pathological Examination.—Specimen consists of an irregular nodular mass which measures 4.5 x 6 x 4 cm. and weighs 85 gms. The external surface contains numerous cysts and has adherent to it portions of a thin, fatty membrane resembling omentum. Between the cystic areas the tissue is dense and contains numerous points resembling cartilage. On cross-section the specimen is seen to be riddled with cysts, the largest of which measures 2 cm. in diameter, the lining is smooth, and the contents consist of a cloudy fluid. In the centre of the tumor, and surrounded by the multiple cysts, is a dense mass of whitish tissue which has the consistency of cartilage and contains several points of calcification.

Microscopic examination of sections removed from the wall of the larger cysts shows a pronounced fibrous overgrowth which surrounds and distorts the pancreatic tissues present. In some instances the acini are well preserved, but for the most part the fibrous stroma has altered the outline of the lobules to a marked extent. The individual acini and ducts are surrounded and separated by the fibrous overgrowth which has isolated small groups of acini. Islands of Langerhans are present, many of them appear normal and others are infiltrated with red blood-cells. The stroma for the most part is rich in cells but in some places it has undergone hyaline degeneration and contains few cells. With the exception of these areas it is well vascularized, the vessels having been recently formed and most of them are congested. In the centre of the specimen the glandular tissue practically disappears, the tissue has a hyaline-like appearance and contains many points of calcification. In the areas in which the fibrous overgrowth is most intense, many of the acini show slight degrees of dilatation. The cysts are lined with epithelium which is cuboidal in shape in the small cysts and flat in the larger ones. The epithelial lining is composed of a single layer in many cysts, in others it is heaped up and in many of the larger ones the lining is entirely absent. The contents of the smaller cysts is composed of blood, and traces of blood-pigment are found in the fibrous stroma.

The fluid in the cysts is slightly acid, and microscopically contains debris, many erythrocytes and a few epithelial cells. The examination for ferments was not made, as the specimen was fixed in formalin soon after removal.

The gross features and the microscopic study of the specimen indicate that the cysts belong to the retention variety, and that the chronic pancreatitis is to be held responsible for the process. The history of repeated attacks of jaundice indicates that the pancreatitis may have originated in infection from the biliary passages. The presence of calcification in the cyst wall has been mentioned in the reports of other cases but is usually associated with the pseudocysts of traumatic origin.

Pancreatic cysts may be divided into four main groups: The proliferation cysts (adenocystoma), degeneration cysts, pseudocysts, and retention cysts.

The proliferation cysts are to be regarded as new formations, and are not common, as Kleinschmidt in 1907 collected 21 cases from the

literature. Lazarus states that the adenocystoma is the most common form of cyst, and believes that many cases are not recognized because, in the surgical treatment, the cyst is merely drained, and its true nature not appreciated. This statement is disputed by other writers, the majority of whom regard the traumatic pseudocyst as the most common form.

The epithelial and connective-tissue proliferation in the adenocystoma results in the formation of papillary projections into the cyst, the condition resembling greatly the cystoma of the ovary. When epithelial proliferation is demonstrable, the differentiation between the adenocystoma and other cysts is not difficult; but when the epithelial lining disappears, the differentiation becomes impossible in some cases. As a rule, however, the epithelium persists in the smaller and more recently formed cysts, although it has totally disappeared in the larger ones. The destruction of epithelium is probably due to pressure atrophy, as it seems unlikely that the pancreatic secretion would destroy epithelium and have no action on the surrounding connective tissue (Korte). Trypsin has never been found in the cyst contents, although in a few instances ferments reducing sugar and fat have been isolated.

The adenocystoma are most commonly found in the tail of the pancreas. In Kleinschmidt's 21 cases, 2 arose in the mid portion; in 4 the cyst involved the entire gland, and in the remaining the tail was the seat of the growth. The tumor is attached to the pancreas by a broad base, is rarely pedunculated, and is always surrounded by a firm, fibrous capsule which separates it from the pancreas.

The pancreas in a small number of cases is the seat of chronic inflammation; this is regarded by Lazarus as an important etiological factor, for conditions favoring stasis of secretion play a rôle in the origin of adenocystoma. It should be mentioned that stasis is more prone to occur in the tail of the pancreas where the proliferating tumors have their site of predilection. Chronic inflammation is rarely general and is limited to the parenchyma about the tumor. As the tumor is located in the tail of the pancreas almost exclusively, the remaining portion of the gland usually is free from disease and its function is undisturbed. The chronic pancreatitis associated with retention cysts, on the other hand, is diffuse in nature, involves much pancreatic tissue, interferes greatly with its function, and leads ultimately to severe disturbances in secretion and metabolism. We find, therefore, that adenocystoma is rarely accompanied by evidence of wasting or weakness, and that retention and other forms of cyst are prone to produce such symptoms.

In the differential diagnosis between adenocystoma and other forms of pancreatic cysts, Kleinschmidt calls attention to the following points:

The majority of adenocystoma occur in females, whereas both sexes are equally affected by the other cysts. The cystomata develop slowly, are progressive, produce no symptoms, there is no history of traumatism. A history of traumatism is elicited in 30 per cent. of the other cases. In these digestive disturbances are common, the course is rapid, there may be intermittent enlargement or actual temporary disappearance of the tumor. The subjective symptoms differ greatly, being absent or slight in the cystoma, they are characterized by severe pain, loss of appetite, vertigo, constipation or diarrhœa in other forms. The general condition of the patient depends on the amount of pancreatic tissue involved by the cyst. There is little or no systemic disturbance in the cystomata, as the growth generally is confined to the tail of the gland. The traumatic and other cysts, however, usually are accompanied by loss of weight, strength and severe anæmia.

The prognosis is always grave. The development in some cases has been so slow that the tumor produced no symptoms, and was only discovered by accident. When the tumor begins to grow rapidly the danger of pressure on important surrounding structures and organs is great. When of large size and the pancreas is involved to a marked extent, alterations in nutrition arise and hasten a fatal outcome. Malignant degeneration is always to be feared.

The degeneration cysts are secondary to various inflammatory and neoplastic processes in the pancreas. Lazarus has found that toxic processes and various infectious diseases, as well as the softening of malignant tumors, are instrumental in producing this form of cyst. Autodigestion of effusions, especially when followed by indurative lesions about the hemorrhage, are responsible for the production of degeneration cysts of traumatic origin.

Injuries to the pancreas followed by hemorrhage can cause four different lesions according to Lazarus:

(1) Indurative pancreatitis, which possibly can lead to formation of true retention cysts.

(2) "Endopancreatic pseudocyst," the formation of which is the result of autopeptic and inflammatory processes.

(3) Degenerative cysts following fat necrosis.

(4) Hæmatoma of the pancreas and omental bursa (peripancreatic pseudocyst).

Pseudocysts are formed from hemorrhagic effusions into the tissues surrounding the pancreas, and almost always follow traumatism and inflammation of the gland. In rare instances autodigestion of encapsulated hæmatomas in the substance of the pancreas may be followed by

cyst formation. Rupture of the peritoneal covering of the pancreas permits both blood and pancreatic ferments to escape into the omental bursa. The reactive inflammation causes connective-tissue proliferation and condensation, a cyst wall is thus formed. When the pancreas is torn, the cyst may connect directly with the necrotic and degenerated gland tissue. The cyst does not contain an epithelial lining, a fact of importance in differentiating pseudocysts from adenocystoma and retention cysts. It should always be borne in mind, however, that the epithelium may have been destroyed by the action of pancreatic ferments. The cyst contents is variable, although traces of blood can generally be found, either in the cyst contents or in the wall. In many cases the fluid is clear, due to absorption of the blood, although cysts of long standing may have bloody contents due to erosion of the vessels, and consequent fresh hemorrhage. There is little doubt that repeated hemorrhages into the cyst are responsible for its enlargement.

A history of traumatism has been elicited in about 25 to 30 per cent. of the cases. Gobell, in 230 cysts which were operated upon, found that a history of traumatism was present 76 times. The symptoms appear in the majority of cases soon after the injury and are accompanied by severe pain and other symptoms indicating disturbance of digestion.

Retention cysts arise either from the duct of Wirsung or from the smaller ducts and acini. The obstruction of the duct is due to pressure, pancreatic calculi, stricture, etc., and is followed by stasis and dilatation, the cystic condition gradually extending to the main branches of the duct. When the process begins in the small ducts or acini, obstruction to the outflow of secretion results in stasis and dilatation. The cause of the obstruction, according to the histologic researches of Tilger, Dieckhoff and others, lies in a preceding chronic pancreatitis. The connective-tissue proliferation accompanying this process surrounds and compresses the pancreatic glands and ducts. The stagnant secretion causes fatty degeneration of the gland cells, the ferments next act upon the pathologically changed wall, the membrana propria disappears by autodigestion, the interstitial tissues undergo necrosis, and by confluence of many acini a small cyst is formed.

The importance of chronic pancreatitis as an etiological factor in the production of retention cysts is recognized by most writers, the majority of whom regard the process as primary. Lazarus endeavored to prove experimentally whether mechanical injuries by inducing interstitial inflammation caused cyst formation. The pancreas was injured by direct trauma, vessel ligation or by the injection of irritating fluids. The resulting connective-tissue proliferation, especially involving the interstitial tissues, caused compression of, and injury to, the acini, adhesions between the capsule and parenchyma, hyperplasia of the periductal tissues, and an active increase in the number of ducts. As a result of this cirrhotic process, the ducts were cut off and dilatation resulted. By producing subcapsular hemorrhage from trauma, and the injection of small amounts of iodine into the exudate, a reactive pancreatitis was induced and a cyst without lining, the size of a goose-egg, resulted. When a pancreatitis was not induced by iodine injection, the hæmatoma was absorbed and a scar resulted.

The formation of such pseudocysts is aided by the artificial production of pancreatic cirrhosis which favors stasis of secretion in the surrounding tissues. Following traumatism, therefore, pancreatic secretion escapes from the acini; the hæmatoma, the surrounding parenchyma and tissue shreds are digested. In the periphery a reactive inflammation leads to the formation of a capsule and further absorption is retarded by the chronic induration.

Lazarus gives the name of "intrapancreatic pseudocyst" to formations of this kind, the traumatism and cirrhosis being the important factors. Tilger and Dieckhoff believe, however, that hemorrhage into the parenchyma never causes cyst formation, and that when traces of blood can be demonstrated, the hemorrhage is to be regarded as secondary.

Honigmann states that endopancreatic cysts can arise in two ways: through cystic transformation of hæmatoma arising in the gland parenchyma, or upon the basis of a chronic interstitial pancreatitis. In the first case the pancreatic ferments induce degeneration of the blood and tissues, and the cyst may reach great size if the normal resorptive ability of the pancreas is retarded. The experiments of Lazarus show that the reactive inflammatory processes in the surrounding tissues have a marked tendency to retard absorption. This form of cyst, as in the more common peripancreatic pseudocysts, occurs a short time after the injury is inflicted, and differs greatly from the chronic course pursued by the cysts secondary to chronic indurating lesions.

The chronic pancreatitis present in many of the cases reported has been secondary to systemic infections, such as syphilis, toxæmias, etc., or to local infection most commonly arising from the biliary passages. Honigmann points to the possibility of traumatism as a factor in producing chronic pancreatitis. The healing of many small foci of hemorrhage, with scar formation, and connective-tissue proliferation may directly cause sufficient contraction of tissues to cause stasis of secretion and dilatation, and thus produce retention cysts.

It seems feasible from these views to conclude that true retention

cysts in the majority of cases are due to a preëxisting chronic pancreatitis. In most of the cases the pancreatitis follows some general infection, but, in rare instances, traumatism may invoke a local reaction which in turn leads on to the cyst formation.

The author desires to thank Dr. C. H. Frazier for permission to record this case.

REFERENCES

Kleinschmidt: Arch. Naturw., 1907, i, 177.
Lazarus: Zur Pathogenese d. Pancreascysten.
Tilger: Virchow Arch., 1894, cxxxvii, 348.
Honigmann: Deut. Zeit. Chir., 1905, lxxx, 19.
Guleke: Ergeb. der Chir. und Orthopedie, 1912, iv, 408.

SUBLUXATION OF ULNA

Dr. John H. Jopson showed a case of subluxation of the lower end of the ulna in a girl aged fifteen with the following history: Eighteen months before he first saw her she had fallen and fractured her right wrist and was told, after an X-ray examination, that the wrist was broken in two places. She wore splints for six weeks. She has had more or less trouble with the wrist since that time, and more especially since she went to work in a cigar factory two months ago. Since that time there has been noted considerable pain and deformity. Examination of the wrist showed a deviation of the hand towards the radial side. There was no silver fork deformity. In pronation the normal prominence of the head of the ulna was present and even somewhat exaggerated on the back of the wrist (Fig. 8). On supination a well-marked subluxation of the lower end of the ulna forward was noted, and the articular surface could be readily palpated on the front of the wrist (Fig. 9). In this position of the hand there was a marked groove between the dorsal surfaces of the bones, and the sigmoid cavity of the radius could be palpated on the back of the wrist. Reduction and re-dislocation occurred with each motion of pronation and supination respectively, and these movements were painful. The X-ray showed an old Colles fracture of the wrist in good position, about half an inch above the end of the bone. There was an unhealed fracture of the styloid process of the ulna. The fracture of the radius had apparently resulted in shortening due to impaction. The ulna seemed longer than its neighboring bone, although this did not show prominently in the X-ray.

The operative problem seemed to be to shorten the ulna, to fix the bones in their normal relation by re-attaching the styloid process and

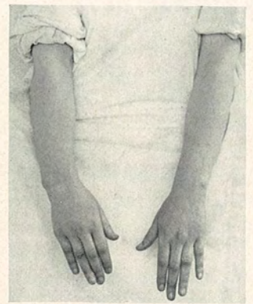


Fig. 8.—Subluxation of the ulna.

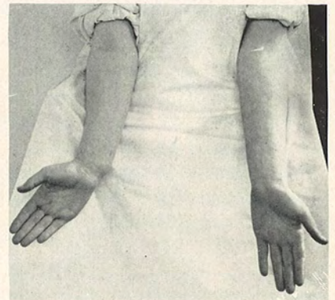


Fig. 9.—Subluxation of the ulna.

with it the triangular cartilage in their normal positions, and to secure additional fixation by suture of the ends of the radius and ulna to each other. The following operation was performed: An incision about three inches long was made on the dorsal surface of the ulna, parallel with, and near its radial border. The posterior ligament of the wrist was severed and retracted, exposing the head of the ulna; the periosteum was elevated, and the end of the bone with its articular surface resected for about 1 cm. The edges of the sawed surface were rounded and a small hole drilled through the outer border. The periosteal covering of the adjacent borders of the radius and ulna was exposed and several sutures were passed, fastening the two bones together where they were in contact. Another suture was passed through the triangular cartilage and around the fractured styloid process, and through the hole which had been drilled in the head of the ulna. When this was tied the styloid process was brought in contact with the resected end of the bone. The posterior ligament was reunited and the wound closed. Both silk and chromic catgut sutures were used. The arm was dressed in pronation on a palmar splint. The wound healed by primary union, but a small aseptic abscess developed as the result of irritation from one of the silk sutures, and a sinus remained for several months until the silk suture had separated and could be removed, when it promptly closed.

The result has been most gratifying. The patient shows perfect restoration of the movements of the wrist, supination and pronation being practically complete, with no tendency to a return of the luxation, and she is again working at her trade of cigar maker. She says that the wrist hurts her sometimes, especially in damp weather. The hand and forearm seem nearly as strong as normal.

Dr. Jopson further remarked that in the Transactions of the New York Surgical Society (ANNALS OF SURGERY, June, 1913) is the report of a case presented by Dr. William Darrach under the title of "Habitual Forward Dislocation of the Head of the Ulna," in which the symptoms were almost precisely the same as those which this patient exhibited. In Darrach's case the condition followed a series of injuries to a chauffeur, the radius being twice fractured by the back kick of an automobile, and fracture of the styloid process of the ulna being associated with it. The third injury, in which the wrist had been injured but not fractured, had resulted in this type of subluxation. The head of the ulna slipped out on supination and returned to its normal position on pronation. There was increased antero-posterior mobility at all times, and an X-ray showed the ulnar styloid to be still ununited, and a back-

ward curve of the radius was present due to imperfect reduction of the fracture.

As Darrach remarked, luxations of the lower end of the ulna which are not associated with fracture of the radius are rare, there being 33 reported cases. With fracture of the radius the condition is much more common. He points out that even when the accident of dislocation has been recognized and reduction completed, a weakness at this joint may remain due to imperfect repair of the structures on which the strength of the joint depends, namely, the triangular ligament and the joint capsule. This is especially prone to be the case if the ulnar styloid is broken, as the attachment of the triangular cartilage to its base favors tearing loose of this important structure, which holds the ends of the radius and ulna together. Darrach could find only six cases of habitual dislocation of this joint: 3 reported by Hoffa and 3 by Courtin. He did not find the impairment of function in this case sufficient to call for operation at the time, but stated that if sufficient disability should result he would resect the lower inch of the ulna. In order to repair the damage completely he stated it would be necessary to obtain union between the ulnar head and styloid, and to reef the capsule, and also to overcome the backward bending of the radius with the resulting strain on the anterior portion of the joint capsule.

It is a well-recognized fact that dislocations, partial and complete, of the lower end of the ulna are frequent complications of Colles fracture, especially when associated with fracture of the styloid process of the ulna, and numerous clinical and experimental observations by Pilcher, Moore and others have made clear the anatomical reasons for this association. A persistent recurring subluxation of the type described by Courtin, Hoffa and Darrach, and a typical example of which is that here reported, is due to imperfect repair of the injured parts, especially of the fractured styloid, or to persistent strain on the joint due to imperfect reduction of the fractured radius, or to permanent shortening of that bone as a result of crushing and impaction. It may also accompany fracture of the forearm in its upper portion as in a case of Hamilton's referred to by Courtin, or fracture of the middle third of the radius, as in one of Hoffa's cases, or even certain forms of violence unaccompanied by fracture, or at least in which no fracture has been demonstrated, as from the lifting of a heavy weight, or where a child is violently lifted by pulling on its hand. The last-mentioned cause is emphasized by Tillmanns as one of the commonest etiological factors in subluxations, and while repair in these cases is usually complete and permanent, recurring subluxation may follow, as in one of Courtin's

cases. Tillmanns also emphasizes the difficulty of retaining in place the end of the ulna in those complete dislocations in which fracture of the radius is an associated injury. That recurring subluxations and luxations of the radio-ulnar joint are not more frequently noted is probably because they are not looked for, and also because they do not necessarily impair the strength and usefulness of the joint. We have seen another typical example of subluxation of the ulna only recently in an elderly woman, who had sustained three fractures of the left forearm at various periods of her life, one of the fractures being a typical Colles for which we had treated her; and, aside from the deformity, the patient presented no symptoms. There was an associated fracture of the styloid of the ulna. On the other hand, some of the weak and painful wrists observed after Colles fracture are probably due to this condition, and it is an interesting fact that so many of the systematic works on fractures omit any mention of it, as Darrach has pointed out.

In one case a good result was obtained by following out to a certain extent the indications for operative correction which Darrach enumerated as indicated for restoration of normal relations in the wrist joint in cases such as his, with the exception of straightening of the radius, which was not necessary in our case, as the shortening of that bone was due to impaction and not overriding of a displaced fragment. A limited resection of the lower end of the ulna to shorten that bone was done without fear of compromising the motions of pronation and supination, as experience in cases of compound dislocation and other types of injury and deformity has shown such fears to be groundless. Hoffa operated upon two of his three cases; one a recurring backward dislocation without fracture, and the other a recurring forward dislocation following a fracture of the radius in its middle third. The procedure which he recommended is the opening of the joint capsule by a dorsal incision and the uniting of the periosteum covering the adjacent ends of the radius and ulna by two or three sutures, a simple operation which he found satisfactory in his cases and which he considers superior to the use of retention apparatus as advised by Mayer and others. While Hoffa's operation would be suited to some types of recurring luxation, it would not accomplish its purpose in those the result of Colles fracture with marked radial shortening, and in such we would practise the operation we have described, which combines the essential features of Hoffa's operation and that suggested by Darrach.

Three points might be emphasized: First, the advisability of more prolonged fixation of those fractures of the radius accompanied by

separation of the styloid process of the ulna, which the X-rays have shown to be so common, in order that healing of the triangular ligament and those fasciculi inserting into its side and base may be obtained. Secondly, the more careful investigation of cases of weak and painful wrists following fractures to determine the causes of the impairment of function. Lastly, the consideration of an attempt to relieve by operative measures those cases in which such pain and impairment of function can be traced to imperfect repair of the structures mentioned.

TUMOR OF CAROTID BODY

Drs. John H. Jopson and John A. Kolmer reported the history of a case of tumor of the carotid body as follows:

A woman, twenty-seven years of age, was admitted March 18, 1913, to the Polyclinic Hospital, discharged March 30, 1913. Married three years ago; one child eighteen months old; now in the fifth month of her second pregnancy. In July, 1911, one month before her child was born, she first noticed a small swelling below the angle of the jaw on the right side of the neck. This gave her practically no pain and has increased slowly in size. At the present time the patient presents herself with a hard, painless, movable ovoid swelling about the size of a pigeon's egg in the right upper cervical region, which resembles a tuberculous lymph gland. There is a small white scar below it near the anterior border of the sterno-cleido-mastoid muscle which has been present since childhood, and probably represents the scar of an old abscess. The diagnosis was tuberculous lymph adenitis.

Operation, March 19, 1913: Oblique incision in crease of neck over tumor. Removal by dissection of the solid tumor was accomplished without great difficulty, except at its anterior inferior border, where it was densely adherent, and could not be separated from the external carotid artery until that vessel had been doubly ligated and divided. The gland lay in the bifurcation of the common carotid artery adherent to, and apparently compressing, the external carotid which was smaller than usual, probably as the result of pressure, and was not identified as the external carotid until it had been ligated. The wound was closed and primary healing occurred, the patient being discharged cured at the expiration of eleven days. The tumor was sent to the laboratory of the Polyclinic Hospital for examination, and the following report was returned:

> Specimen was received in the laboratory in 4 per cent. formalin. The mass is roughly ovoid in shape; well encapsulated; quite firm and somewhat

Fig. 10.—Tumor of the carotid body.

elastic; roughly nodular and greyish-white in color. The cut surface is smooth, white, homogeneous and even in texture.

Microscopical Examination.—Sections present a well-defined capsule with irregular bands of connective tissue extending into the depth of the tumor (see Fig. 10). These bands divide and subdivide, forming an alveolar structure. The connective-tissue cells of these septa are, as a rule, long spindle-shaped cells, well defined and with mature oval nuclei. Scattered about are groups of younger connective-tissue cells with oval and slightly vesicular nuclei. Portions of the tumor show well-defined alveolar arrangement, but in most areas the structure is more diffuse. In the alveolar portions the cells are irregularly grouped, well defined, polyhedric or round, with round or oval, sharply defined nuclei. The protoplasm of these cells is quite homogeneous with poorly defined partitions between individual cells. The size of these cells varies, and evidences of mitoses are present. In a few places the alveoli appeared to be grouped about or are intimately related to blood spaces with several layers of polyhedral cells grouped about the layer of intimal cells. The vascular supply of the tumor is not especially abundant. The blood-vessels are not well defined, and the walls are thin and often present only the endothelial lining. In many areas the typical chromaffin cells of the carotid gland are to be seen, and, since the normal structure of the gland is so disturbed by the new tumor tissue, these have aided in establishing the relation of the tumor to this gland.

Diagnosis.—Endothelioma or perithelioma of the carotid gland.

It will be seen that this case resembled, in its clinical course and operative finding, a number of the reported cases of tumor of the intercarotid gland, or carotid body. The number of cases on record is rapidly increasing as the attention of surgeons and pathologists is directed to the subject. Keen and Funke in 1906 published the first careful study of the subject in America, collecting 29 cases. The recent articles by Callison and Mackenty (ANNALS OF SURGERY, December, 1913) and Balfour and Wildner (*Surgery, Gynæcology and Obstetrics,* February, 1914) are quite exhaustive studies of the subject from the clinical and pathological standpoints. Callison and Mackenty brought the statistics up to date by collecting 31 cases in addition to Keen and Funke's series of 29, making 60 in all, and to these may be added the case reported in Balfour and Wildner's study of the anatomical and histo-pathological side of the subject, and our own case. Other cases are probably also already on record.

To reiterate the salient points of this case it will be noted that, as in the large majority of cases of this affection, the diagnosis of carotid tumor was not made before operation, nor, indeed, until the pathological report had been returned. This has been the common history in these cases. The tumor was, of course, solitary, of slow growth, of moderate size, and gave rise to no symptoms except a slight disfigurement. This is

also the usual clinical history until the tumor reaches a stage where it takes on rapid growth and assumes a more or less malignant nature, when recurrences, metastases and involvement of the neighboring cranial and sympathetic nerves may be excited. At operation the tumor was so closely adherent to the external carotid that that vessel was doubly ligated and divided before it could be removed. Fortunately, the tumor had not advanced to the left, where it surrounds the vessels and renders ligation of the three carotids necessary to its removal. Of 54 operated cases the external carotid was ligated singly in 7 instances, and the three carotids in 32 cases. With the necessity of triple ligation, the mortality and complications from embolichal softening, secondary hemorrhage and injury to neighboring nerves increases very rapidly, and the death-rate reaches the proportions in all operated cases of 22 per cent. (12 deaths in 54, according to Callison and Mackenty's statistics).

The pathological report in this case was endothelioma or perithelioma. These are the usual pathological findings. One case was reported as carcinoma. The demonstration of chromaffin cells by Kolmer clinched the pathological diagnosis of carotid tumor in our case.

PARTIAL COLECTOMY FOR INTESTINAL STASIS

Dr. John H. Jopson reported the case of a woman, aged thirty-four, who had been ill since November, 1911. Her symptoms were those of intestinal stasis, obstinate constipation, abdominal pain aggravated by eating; eructations, great loss of weight and quite marked neurasthenic symptoms. When first seen she was of a tall, thin, gastroptotic type of female, but this was largely due to the fact that she had lost 30 or 40 pounds within a few months. She had a marked secondary anæmia. In May, 1912, Dr. Jopson had removed her appendix which showed chronic interstitial changes, and separated numerous broad, thin adhesions between the first portion of the duodenum and the transverse colon which were causing a moderate obstruction of the first-mentioned portion of the bowel. The stomach showed no disease. She was not in the least improved by this operation, but continued with the attacks of gastric pain, gas, inability to take anything in the line of solid diet, and with some hyperacidity. The constipation became much more obstinate. Inflation of the stomach showed a very moderate ptosis.

The patient was placed on a modified rest cure in the hospital, but vomiting, abdominal pain and distress, and eructations continued.

In August, 1913, the abdomen was reopened. Careful examination showed that adhesions which were divided fifteen months previously had not reformed, the large bowel being remarkably free, except at the

hepatic flexure of the transverse colon. At this point the bowel was acutely kinked; the ascending colon and transverse colon were bound together by adhesions of the same avascular nature as those discerned at the first operation. The ascending colon was much distended. The distal portion of the transverse colon and the descending colon were moderately collapsed, and there were a very few adhesions at the splenic flexure, which were divided.

The terminal portion of the ileum was divided and the cæcum and ascending colon and hepatic flexure and the first portion of the transverse colon were excised. A lateral anastomosis was performed between the terminal portion of the ileum and the transverse colon beyond the point of its division.

The patient made a good operative recovery, and when seen four months after operation she was greatly improved. She had gained about 16 pounds in weight. Her constipation was entirely relieved. The stomach symptoms, indigestion, eructations, etc., were very much less and improvement was still progressing. She could eat a normal meal, at least once a day; and, while she still complained of some lumbar pain, especially marked on the right side, which she had had for several years and which was associated with a very movable kidney on this side, she was, comparatively speaking, a well woman in contrast to her condition before the first and second operations. Since then she has not been ill enough to consult her physician, although he recently heard from her to the effect that she was again having some gastric indigestion, mucus in the stools, and some of her old symptoms, so that the final result of the operation cannot yet be stated.

CYSTIC LYMPHANGIOMA OF THE GREAT OMENTUM

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The question of cyst formation in the great omentum has been discussed to a certain extent in the literature, some 50 or more individual case reports, so far as I have been able to ascertain, having appeared to date, notwithstanding which the subject seems to be but very imperfectly understood; there are great differences of opinion with regard to the origin and significance of such cysts, and indeed comparatively few of the reported cases have been studied with sufficient care to permit of a definite determination of their point of origin and mode of formation. That the condition must be a distinct rarity is shown by the fact that only this half hundred so-called cases of omental cysts are available for study—and a number of these must on careful analysis be discarded—but it presents, nevertheless, several points of interest from both the pathological and clinical aspect.

My interest in the subject has been aroused by a case which came under my observation some months ago. The patient was a colored woman, thirty-four years of age, who was admitted May 5, 1913, to the Gynecean Hospital, service of Dr. H. D. Beyea, for the removal of a large tumor, which had been causing a noticeable increase in the size of her abdomen for about eight years. On examination, a hard nodular mass could be felt, extending well above the umbilicus; a diagnosis of uterine myoma was made, and was found upon opening the abdomen to be correct, the uterus itself being somewhat enlarged and multinodular, and having attached to its fundus an almost pedunculated tumor about the size of a man's head. There were numerous intestinal adhesions, and closely attached to the upper portion of the large tumor was the great omentum, which presented the remarkable cystic condition described below. The uterus, both tubes, and right ovary were removed, as was the great omentum, after ligation of the vessels close to the transverse colon. The left ovary and appendix appeared normal, and were not removed. The patient made an uneventful recovery.

Specimen.—The uterus proper measures 9.5 x 8 x 8 cm.; its surface is covered by extensive fibrous adhesions, and on section its walls are seen to contain numerous intramural nodules, varying in size up to 3 cm. in diameter. The large tumor is roughly kidney-shaped; it measures 22 x 16 x 16 cm. Its surface is likewise covered in places by adhesions, and at one point it shows a roughened area about 4 cm. in diameter where it was attached to the fundus of the uterus. Microscopically, all the tumors show the characteristic appearance of myomata. Each tube has been transformed into a small hydrosalpinx; the right ovary

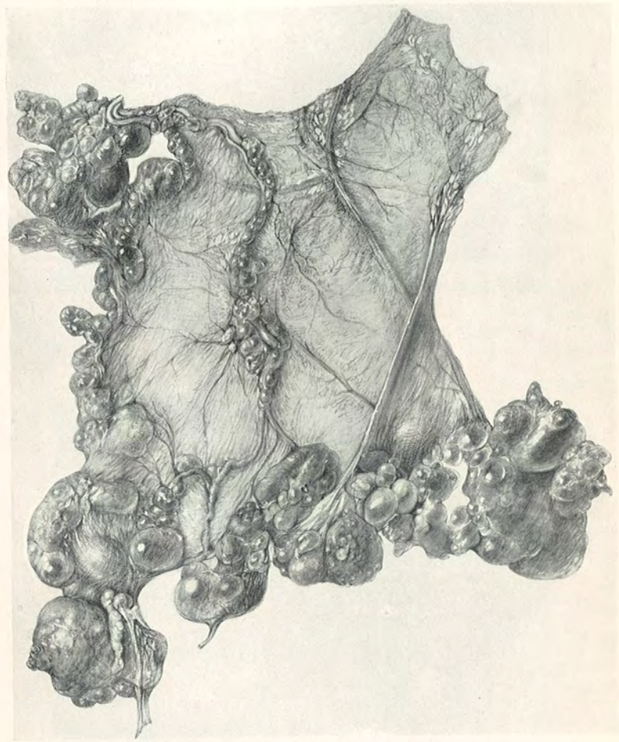

Fig. 1.—Macroscopic drawing of omentum with cysts.

FIG. 2.—Section through wall of one of the larger cysts.

FIG. 3.—Wall of one of the larger cysts, showing numerous lymph spaces of various sizes, lined with endothelial cells.

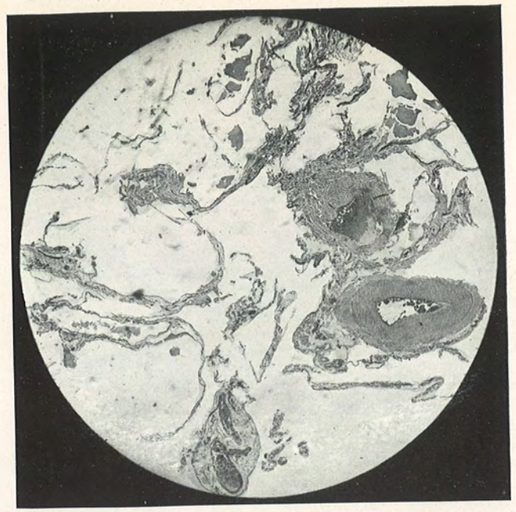

FIG. 4.—Section through the blood-vessels seen traversing the central portion of the omentum in Fig. 1, showing a cross-section of the artery and vein, surrounded by numerous thin-walled, cystic cavities. Very low magnification.

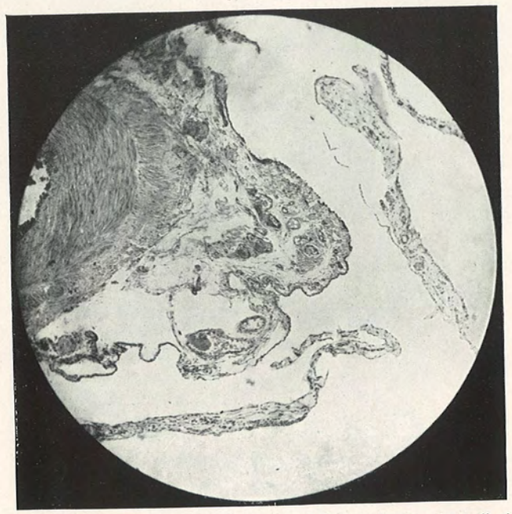

FIG. 5.—Higher power photograph of a portion of Fig. 4, showing the wall of the artery, and surrounding cystic cavities. These are lined by a distinct layer of flat cells with deeply staining nuclei.

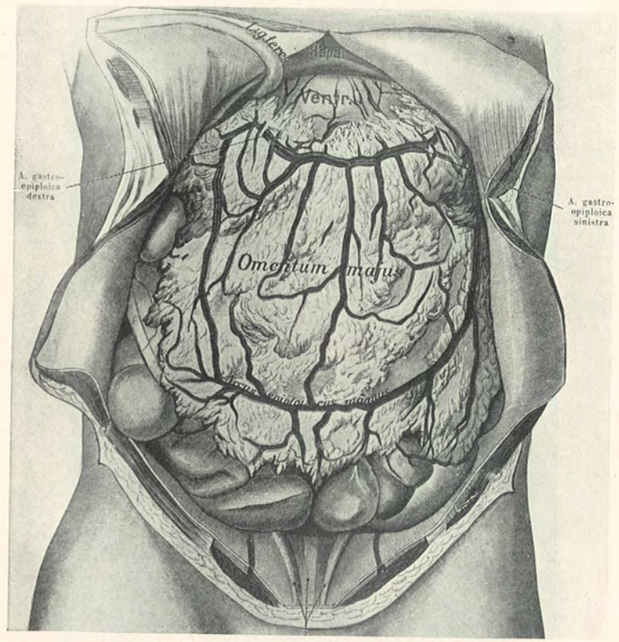

FIG. 6.—Blood-vessels of the great omentum (after Broesike).

contains a small corpus luteum cyst, but is otherwise normal, save for numerous adhesions on the surface.

By far the chief interest of the specimen centres in the *great omentum* (Fig. 1). This is a roughly quadrilateral sheet, measuring 20 x 18 cm. The central portion is thin and delicate, presenting the appearance of normal omental tissue, with very little fat. Around the entire circumference, however, are closely grouped masses of thin-walled cysts, which, when they first presented in the abdominal wound, resembled nothing so much as clusters of grapes. When the omentum had been fully exposed, however, it almost appeared as though a somewhat atypical segment of colon were attached completely around its free border, this appearance being furnished by the continuous masses of cystic bodies on the periphery. The cysts vary in size up to several centimetres in diameter, but on account of their extensive confluence it is not always easy to determine the exact size of any particular individual or group. The external surface of the cysts is for the most part smooth and glistening, the walls are thin and delicate, the contents clear, watery fluid. In addition to the larger cyst masses, which are limited exclusively to the periphery of the omentum, strings of much smaller ones are seen closely hugging one or two of the larger blood-vessels as they cross the central portion.

Microscopic sections through the cyst walls show these to be composed of rather loose connective tissue, containing numerous much engorged capillary blood-vessels, and a fairly intense and widely disseminated infiltration of small round cells. No fat is to be seen. Separating this connective tissue stroma from the cyst cavities is seen in every instance a single layer of flat cells, with distinctly staining nuclei, very strongly suggestive of the endothelium lining lymphatic channels (Figs. 2 and 3). These are present in the largest as well as in the smallest, and in all intermediate-sized cysts; in many places the thicker septa between the larger cavities contain numerous small, endothelial-lined spaces which almost certainly represent merely somewhat dilated lymph capillaries (Fig. 3), and since there is a continuous gradation between these and the largest of the cysts, the assumption seems strongly justified that the entire process has had its origin in a cystic dilatation of the lymphatic channels of the omentum, due to causes which will be discussed later. Still further evidence in favor of this etiology is furnished by examination of a cross-section through the blood-vessels with small surrounding cysts seen traversing the central portion of the specimen (Figs. 4 and 5). In this section we see an artery and vein, surrounded by a very small amount of loose areolar tissue, and then by a conglomerate of delicate-walled cystic cavities, each lined by the type of cells described above. From their structure and arrangement there can be practically no other interpretation of these spaces than that they represent much dilated perivascular lymph-channels. In most of the larger cyst cavities is seen a small amount of homogeneous material, which in eosin-hæmatoxylon preparations takes a diffuse pinkish stain.

The question naturally arises, as to whether the occurrence of this marked degree of cyst formation about the periphery of the omentum, the remainder of the organ being but slightly involved, and then only along the course of a main blood-vessel, can be in any way ex-

plained by the anatomical arrangement of the lymphatics. A careful search through more than a dozen of the more important works on anatomy [1] has failed, however, to bring to light a single description of the arrangement of the lymphatic vessels of the great omentum, nor does its blood-vascular system receive, in many instances, much better treatment. Many of the authors dismiss it with the bare statement that the gastro-epiploics give off descending branches which pass down into the omentum, what happens to them after they get there being left to the reader's imagination; in some instances, however, the statement is made that the descending branches pass down through the anterior layer of the omentum to the free border, and then turn upward in the posterior layer, to anastomose with vessels coming from the transverse colon. Likewise, in most of the drawings illustrating the vascular supply of this region of the body, the lower portion of the omentum is left out entirely, or if it is included, its vessels are represented merely as a few trunks, running straight downward, and after a few subdivisions, ending as terminal branches near the free border.

Norris, however, who has made a careful study of the finer structure of the omentum, goes into the matter somewhat more in detail. He says, "In some cases there are four main arteries which come down laterally on the sides of the omentum, two on the anterior and two on the posterior surface. More frequently, however, the organ is supplied by a central artery in the anterior, and a corresponding artery in the posterior leaflet. As a general rule, three distinct branches are given off from these vessels, which run transversely across the surface of the omentum. They are about an equal distance apart, the lowermost branch corresponding to nearly the lowermost portion of the omentum. . . . The arteries are accompanied by veins." The only drawing I have been able to find that brings out in any way this formation of a transverse vascular arc near the free border is one in Broesike's Anatomic Atlas, showing a distinct arcuate anastomosis between the vertically coursing blood-vessels just within the free border of the omentum (Fig. 6). Although this vascular arrangement is undoubtedly of very irregular, and probably infrequent occurrence, it is of much interest in connection with the subject under discussion, for if we may assume, as seems reasonable, and as Norris specifically states, that in the omentum "in a general way, the chief lymph-channels follow the larger

[1] Including Gray, Holden, Piersol, Cunningham, Morris, Gerrish, Quain, Deaver, Sobotta-McMurrich, Toldt, Rauber-Kopsch, Spalteholtz, Testut, Poirier-Charpey, and Sappey.

blood-vessels"—a condition which certainly holds in the remainder of the gastro-intestinal tract, and in many other portions of the body—may not this anatomical condition explain the production of the more or less continuous chain of cystic structures, evidently of lympho-vascular origin, around the entire edge of the great omentum? If a considerable lymphatic trunk accompanies a vertical artery on each edge of the omentum, and also this "arcus epiploicus magnus," as Broesike calls it, any factor that would lead to its cystic dilatation would produce exactly the conditions described. This factor may well have been, in the present instance, furnished by the inflammatory condition which had at some time existed throughout the lower abdomen and pelvis, as is evidenced by the extensive adhesions and by the round-cell infiltration in the cyst walls. Especially does it seem plausible that the adherence of practically the entire free border of the omentum to the large uterine tumor may well have interfered with the circulation in lymphatic trunks along the vascular arch mentioned above, causing thus mechanically their cystic dilatation, the active inflammatory process acting in addition as a stimulus to proliferation of the endothelial elements, and thus resulting in the production of a true lymphangioma. The much less marked, but still distinctly evident, involvement of the lymphatics accompanying the central vessel in its vertical course would be explained by the less active inflammatory process, and absence of adhesions, in this portion of the omentum.

A certain amount of support to this hypothesis would seem to be furnished by one case, reported by Gairdner in 1851, in which almost identical conditions were present, and resulted in the production of very similar cystic formations in the omentum, this being the earliest instance of omental cysts on record. The patient was a woman who had a large fibroid tumor of the uterus. At autopsy there was found beneath the anterior layer of the great omentum a cystic structure consisting "of a highly transparent closed sac, between 3 and 4 feet in length, and from ½ to 1½ inches in breadth, having a lobulated appearance externally like that of the distended colon, but in no part subdivided by any approach to complete septa. The fluid in the sac was a transparent colorless serum, containing numerous flocculi." An interesting feature of this case was that there were indications of a tendency to cyst formation in other parts of the body also, small globular cysts being found in the cellular tissue of both groins, in the velum interpositum, and in the pineal gland.

Another case of some interest in this connection has been reported recently by Stillman. His patient was a woman of forty-two, whose abdomen had been

increasing in size for about five years; at operation a pedunculated fibroid tumor the size of a man's head was found attached to the uterus, and also to the omentum by a vascular pedicle as thick as the thumb. "Distributed throughout the omentum were numerous elongated, tortuous, exceedingly thin-walled cysts, from 1½ to 2 inches in diameter, showing a characteristic lobulation or sacculation comparable to that of the distended colon. The gastrocolic omentum was also affected, but to a much less extent, the dilatations here being much fewer and none larger than a lead pencil; they were unmistakably dilated and tortuous lymph-vessels." A second, strikingly similar case, reported by Fitz in an unpublished Lane lecture (San Francisco, 1910), is also referred to by Stillman. "It was a case of enormously dilated lymphatics of the omentum, occurring in a woman who also had a fibroid of the uterus, to which the omentum was attached. The omentum was reduced to a web of connective tissue supporting the tremendously dilated lymphatics."

It is not my purpose here to review in detail the literature upon omental cyst formation in general, since this has been done more or less extensively by practically every recent writer upon the subject. In 1911 Dowd was able to collect 37 cases which had been reported up to that time as cysts of the omentum, and his tabulation has formed the basis of most subsequent articles in this country, while in the German literature it has been taken over practically intact by Monnier, who in a recent extensive monograph has added 5 more, bringing the total (including Dowd's own case) up to 43. In addition, however, cases have also been described under the general designation of omental cysts by Frank, Giannettasio, Lipscher, Markoe and McPherson (3 cases), Thornton (2 cases), Buckley, Funk, and others, bringing the total number of instances known in which some form of cystic process has occurred in the omentum up to something over 50. The exact number is of little moment, however, and would be practically impossible of determination, for many of the descriptions are so meagre, and so lacking in essential details, that the cases to which they refer cannot be definitely classified. Moreover, even the most cursory perusal of these reports shows that they cover a distinctly heterogeneous group of pathological processes, many of which have practically nothing in common other than their anatomic situation in relation with the omentum.

Leaving aside entirely the group of cystic formations due to hydatid disease—which is not included in the above-mentioned tabulations, although it occasionally involves the omentum in conjunction with other abdominal viscera—we find that some of the so-called cysts represent nothing but secondary degenerations of malignant tumors (Hasbrouk) or hematomas (Dowd, Simon), or sacculated collections of

fluid following traumatic rupture of an abdominal viscus (Cotman). Others were only parasitic with regard to the omentum, having apparently arisen primarily in some other organ, such as the ovary (Waldy), and others, again, were merely secondary implantations in the omentum from malignant ovarian growths (Thornton). In one unique instance, the origin was probably due to a mycotic infection which had penetrated the walls of the intestinal tract (Ris).

For these various reasons, therefore, quite a number of the reported cases must be rejected from a discussion of cyst formation proper in the great omentum. Those that remain, and which may be considered *true cysts,* in that they represent, as far as can be determined, the result of actual proliferative or secretory processes, have for the most part presented clinically one of two chief types, although the dividing line is by no means a sharp one, and some cases occupy a distinctly borderline position. In some instances the omental tumor consisted of a single or but few loculi, was large and prominent, and was itself the cause of the patient's seeking surgical attention; in others, the cysts were small, multitudinous, and were scattered throughout the omentum, or chiefly about its periphery, as in the present specimen. In this type, the discovery of the omental condition has usually been incidental at operation or autopsy, no suspicion of its existence having arisen clinically. In the former type of tumor, however, the distention of the abdomen has often reached enormous dimensions, as in the one reported before this society a few years ago by Rodman. These cysts have developed at all ages, from earliest infancy to adult life; when occurring in infants and children, the preoperative diagnosis has almost universally been tuberculous peritonitis; when occurring in adults, either this, or in female subjects, ovarian cyst. Under these mistaken diagnoses repeated tappings have been performed in a number of instances, but re-formation has invariably followed, eventually necessitating radical extirpation.

While a number of authors consider many of these larger as well as the smaller cysts of lymphatic origin, and, indeed, Jacoby maintains that all true omental cysts are of this etiology, a number of other explanations have been offered to account for them. Owing to their frequent occurrence in infants and young children, a congenital origin from embryonic rests between the layers of the omentum has been strongly advocated by some investigators. Of several cases so diagnosed, the one in which this explanation appears the most plausible is that reported by Henke, in which at autopsy numerous small cysts were found scattered throughout the omentum, and also pretty generally throughout the visceral peritoneum of the abdomen. These

cysts contained a seromucinous fluid, showed the presence of numerous smooth muscle bundles in their walls, and were lined by a layer of cuboidal to tall cylindrical epithelium.

Another hypothesis that has been offered is that the cysts arise from the flat cells covering the serous coat of the omentum (Seefisch, Himmelheber, Karas), and represent therefore practically nothing more than loculated collections of peritoneal fluid. That cyst formation from the surface-serosa does occur in many of the abdominal and pelvic organs, especially the tubes and ovaries, is of course well known, the inflammatory factor here probably playing an important rôle. Karas, whose case quite closely resembles in some respects the one reported in this paper, makes a great deal of the fact that the cysts were lined with epithelial-like cells, many of which apparently showed in places the presence of *cilia,* structures which certain authors claim to have demonstrated as a normal constituent of the lining cells of the peritoneum. From this fact, Karas concludes that the cysts in his case were of peritoneal origin; he thinks, however, that this cyst formation on the part of the peritoneum was the result of some abnormality in the embryonic development of the omentum, since he could not find anything to suggest a post-embryonal occurrence, such as inflammation, notwithstanding the fact that a marked round cell infiltration was present in the cyst walls.

At first sight, this theory of origin was the one which most strongly suggested itself as the explanation for the occurrence of the cysts in the present instance, until more careful examination of the specimen led to the different conclusions stated above. To sum up, therefore, it may be said that while the possibility of the origin of some cases of true cysts of the omentum from embryonal rests, or from the surface peritoneum, cannot be positively denied, it may be considered demonstrated beyond any reasonable doubt that in other instances the lymph-vessels are the starting point for such growths, and this latter explanation would certainly appear to be the one which would apply in the majority of cases.

With regard to the diagnosis of omental cysts, there is not a great deal to be said. In view of the rarity of the condition and the lack of any distinctive symptoms, it is not strange that in only two or three of the reported cases has even a tentative diagnosis been made before opening the abdomen. Brandt claims to have diagnosed a large cyst of the omentum "by exclusion," and in one of Stillman's cases a preoperative diagnosis of "either an omental cyst or an ovarian cyst with a very long pedicle" was made. The presence of a distinctly sacculated collection of fluid, not associated in any way with the genital organs, might, in the absence of any symptoms suggestive of a tuberculous condition, lead to the suspicion of omental cyst; beyond this, however, it is hardly possible to go with our present diagnostic resources.

The only rational treatment for the condition is extirpation of the cyst-bearing portion of the omentum. Tapping is of course, as has been stated, not only ineffectual, but may give rise to hemorrhages and adhesions, which markedly increase the difficulty of subsequent operation. It is possible that in a very occasional case drainage and marsupialization might be necessary, but with the present development of surgical technique, and in view of the excellent results which have followed the more radical type of operation in most of the reported cases, instances in which any other procedure would be indicated must be considered decidedly the exception.

BIBLIOGRAPHY

(All cases included in the tabulations of Dowd and Monnier, unless specifically referred to in the text, are omitted.)

Brandt: Omentalcyste. Norsk. Mag. f. Laegevid., 1893, No. 8, Zentralbl. f. Gyn., 1894, xviii, 991.
Broesike: Anatomischer Atlas d. ges. menschl. Körpers, Berlin, 1904, vol. ii, p. 355.
Buckley: Dem. in Manchester Med. Soc. Brit. Med. Jour., 1885, ii, 994.
Cotman: Case of Omental Cyst Communicating with the Stomach, following Injury. Brit. Med. Jour., 1902, i, 1267.
Dowd: Cysts of the Omentum. Ann. Surg., 1911, liv, 617.
Frank: Omental Cysts. Amer. Jour. Obstet., 1913, lxvii, 501.
Funk: Cysts of the Omentum; with Report of a Case. Surg., Gyn. and Obstet., 1914, xviii, 70.
Gairdner: A Remarkable Cyst in the Omentum. Trans. Path. Soc. Lond., 1852, iii, 374.
Giannettasio: Cisti ematica dell'omento. Gaz. degli Osped., 1907, xxviii, 939.
Hasbrouk: Enormous Endotheliomatous Cyst of the Great Omentum. Ann. Surg., 1908, xlviii, 206.
Henke: Multipler cystischer lymphangiomähnlicher Tumor der Bauchhöhle. Verhandl. d. deut. path. Gesell., 1899, ii, 251.
Himmelheber: Zur Kenntnis seltener cystischer Bildungen in der Bauchhöhle. Arch. f. Gyn., 1909, lxxxvii, 67.
Jacobi: Cyst of the Omentum. Trans. Ass. Amer. Phys., 1901, xvi, 232.
Karas: Fall von multilokulärer Zyste des grossen Netzes. Virch. Arch., 1907, clxxxviii, 67.
Lipscher: Orvosi Hetilap, 1901, No. 15. Zentralbl. f. Gyn., 1903, xxvii, 92.
Markoe and McPherson: Three Cases of Cysts of the Omentum. Bull. Lying-in Hosp., N. Y., 1912, viii, 70.
Monnier: In Prutz and Monnier, Die chirurgischen Krankheiten und die Ver-

letzungen des Darmgekröses und der Netze. Deutsche Chirurgie, Lfrng. 46k. Stuttgart, 1913.
Norris, C. C.: The Omentum, its Anatomy, Histology, and Physiology in Health and Disease. Univ. Penna. Med. Bull., June, 1908.
Ris: Fall von Cyste des grossen Netzes. Brun's Beitr. z. klin. Chir., 1893, x, 423.
Rodman: Omental Cyst. Internat. Clinics, 1909, 19s., iv, 125; ANN. SURG., 1909, xlix, 427.
Seefisch: Fall von grosser Cyste des Netzes. Deut. med. Wochenschr., 1909, xxxv, 1790.
Simon: Kyste hématique du grand épiploon. Bull. Soc. Anat. Paris, 1858, xxxiii, 30.
Stillman: Lymphangiomata of the Omentum and Omental Cysts. Jour. Amer. Med. Ass., 1911, lvii, 726.
Thornton: Mesenteric and Omental Cysts. Brit. Med. Jour., 1882, ii, 1242.
Waldy: Case of Suppurating Omental Cyst. Lancet, 1889, ii, 642.

DR. J. STEWART RODMAN said that the case to which Dr. Outerbridge referred was one which occurred in his father's clinic and was reported in 1909. The diagnosis was presumably an ovarian cyst of enormous dimensions in a girl of seventeen, and at operation this cystic tumor seemed to fill the entire abdominal cavity; even after opening the abdomen it was still considered an ovarian cyst, but after evacuating the contents of the unilocular cyst it was seen that it did not originate in the pelvis but in the upper abdomen; and, finally, its origin was found to be between the layers of the great omentum, from which it shelled out rather easily. The patient made an uneventful recovery.

DR. P. G. SKILLERN, JR., remarked that there is a type of congenital mesenteric cyst that arises from anlage of tubules of the Wolffian body, which become sequestrated between the layers of the mesentery. An example of this type was reported by Dr. H. C. Deaver in the ANNALS OF SURGERY for May, 1909, page 619. It occurred in a seven-year-old school-girl, in whom symptoms of intestinal obstruction presented themselves. At operation three cysts the size of plums and with clear contents were found between the layers of mesentery in relation with the terminal loop of ileum, so embracing it as to cause the obstruction. It was necessary to resect ten inches of the ileum, together with the cysts. A lateral anastomosis was then performed.

In the differential diagnosis, mesenteric cysts are not uncommonly mistaken for ovarian cysts. In avoiding this error, it is helpful to ascertain if the tumor has grown from the abdomen towards the pelvis or *vice versa*, if an inferior zone of resonance can be obtained by the Trendelenburg position, and if both ovaries are independent of the tumor.

If discovered accidentally, mesenteric cysts should be removed for

prophylaxis of intestinal obstruction, and even for malignant degeneration.

There are four ways of dealing with intramesenteric cysts: (1) By aspiration; (2) by cystostomy and drainage, with or without the use of caustics; (3) by enucleation; (4) by resection of the involved intestinal segment. The first is obsolete because followed by recurrence. The second is useful in the presence of numerous adhesions. The third is ideal when practicable. The fourth is useful in the presence of multiple, juxtaposed cysts.

DR. ASTLEY P. C. ASHHURST asked Dr. Outerbridge whether the arcus magnus, corresponding to the free border of the omentum, was present in his case. That the diagnosis of omental cyst is sometimes made clinically is evidenced by this fact. He recalled hearing his father talk about a case at the Pennsylvania Hospital about twenty-five years ago: he said he had not seen the patient, but from what he had heard he had thought it must be a case of omental cyst, and of all the physicians and surgeons who had examined the patient in the hospital, no one but Dr. William Hunt had made the correct diagnosis. This diagnosis was confirmed by operation.

DR. GEORGE W. OUTERBRIDGE, in closing, answering Dr. Ashhurst's question, said that he could not tell whether in this case there was a blood-vessel running along the free border of the omentum owing to the extensive development of cysts in this region, whereby the relations were largely destroyed. He thought the blood supply of the omentum undoubtedly varied enormously in individual cases, and that the conditions described would probably only be found in an occasional instance.

Regarding Dr. Skillern's statement that omental cysts are closely related to mesenteric cysts in the manner of formation, he would say that most of the true mesenteric cysts are likewise lymphatic in origin. Many of these have chylous contents, a condition not found of course in cysts of the omentum.

PERFORATED ULCERS OF STOMACH AND DUODENUM

DR. GEORGE G. ROSS said that it has so happened that between November 1, 1913, and the first of April, 1914, he had seen five cases of perforation of the stomach or duodenum, and one case which he believed was a perforation of the stomach on the posterior surface at the greater curvature. There was, however, considerable doubt as to the correctness of the diagnosis, the case being the one that he reported to the Academy several meetings back.

The first case he reported was seen by him in consultation and was referred to the wards of the German Hospital, being operated upon by Dr. John B. Deaver during his clinic the same afternoon.

Case I.—An adult man.

History.—Seven or eight years ago had an attack of indigestion which lasted for several weeks. He described this indigestion as follows: a fulness coming on immediately after eating and a feeling that he would be relieved if he could belch, but he could not belch. He was put on milk and toast at that time and some medicine, and after two weeks' treatment regained his normal health, except for constipation which had been the case throughout his life. About three months ago he began to have an uncomfortable feeling of fulness in his stomach, coming on immediately after eating, which was relieved by light diet. He was unable to belch; never vomited; passes considerable flatus. November 14, 1913, he ate a heavy lunch and was very uncomfortable during the afternoon. About 6.30 P.M., while sitting at a desk writing, he had a severe attack of epigastric pain, coming on suddenly and radiating up over the chest. He said his pain was constant, not spasmodic, and was made worse by inspiration. There was no nausea; nevertheless he attempted to empty his stomach by putting his fingers down his throat. He said that once last evening he felt like fainting but got to the outside air and averted it. His pain kept up all night, referred to the back of his neck and right shoulder. Drank a glass of warm milk this morning, retained it, and his pain was not exaggerated. Says bowels have been moving with purgatives but has not passed any flatus lately.

When admitted to hospital his eyes were sunken, pupils normal; heart and lungs surgically negative; abdomen distended, general board-like rigidity; liver dulness diminished; point of greatest tenderness midway between umbilicus and xiphoid: peristalsis present; extremities normal.

Operation.—By Dr. Deaver. Dorsal position. Iodine preparation. Low right rectus incision. Appendix adherent. Appendectomy. Gas and cloudy serum escaped when the peritoneum was opened. Purulent material appeared when the adhesions about the appendix were broken up. Culture taken. Upper right rectus incision. Gas bubbled out when peritoneum was opened. Perforation of the posterior surface of the duodenum. Duodenum was plicated with double linen. *Gastrohepatic* and *gastrocolic* omentum stitched over ulcer. Upper abdomen wiped out with gauze. Posterior gastro-enterostomy done in the usual manner. Pelvis mopped out. Glass tube for drainage. Wound closed in layers to drainage. Dry dressing. Uneventful recovery.

This diagnosis was made in this case from the previous personal history, the character of the onset of the attack, the appearance of the man being hard hit, the location of the pain and tenderness, the board-like rigidity and the early appearance of distention, as demonstrated by the diminished liver dulness.

Case II.—Female, aged sixty-eight, was admitted to the Germantown Hospital, January 26, 1914.

History.—For about three years she has had attacks of indigestion. These would occur every six or seven weeks and would last three or four days. For the last five months these attacks have been getting more severe and frequent. Recently they have occurred every week. Had a severe attack about one week ago, Monday, January 19. On Thursday following she had to go to bed. On Sunday she suffered intense pain in abdomen with constant vomiting. This continued until Monday morning, January 26, when she had a few hours' respite from vomiting; but in the afternoon the vomiting returned following the ingestion of a cup of broth. Bowels have not moved for seven days. Has always had trouble with her stomach since childhood, having spells of acute indigestion coming on three or four hours after eating, causing vomiting. For the last five or six years she has been unable to have a bowel movement without taking a purgative. She has had four children, all living and well.

When admitted her abdomen was tender, very little distended; visible peristalsis. Knuckles of gut could be seen through the emaciated, relaxed abdominal wall. There was very little audible peristaltic sound. The vomiting ceased upon withdrawal of all food and liquids by mouth. The case did not impress him as one of acute mechanical obstruction of the bowels and so she was not operated upon as an emergency case. His diagnosis was malignant growth of the sigmoid with partial obstruction. For several days she remained the same, excepting the failure to empty the bowels of fæces or gas. Her leucocytes were 10,300.

Operation.—Long incision. Right rectus muscle. No evidence of peritonitis, localized collection or malignancy in lower abdomen. A knuckle of ileum was found to be adherent to the stomach at the pylorus, and this, having become kinked, had given rise to mechanical obstruction. When the gut was freed from the stomach wall, a perforation of the anterior wall large enough to receive a lead pencil was exposed. There was no pus in the locality and very little lymph. The perforation was closed by purse-string suture, oversewn with Lembert sutures of linen thread, and reinforced by a graft of gastrocolic omentum. Wound was close without drainage; gastro-enterostomy was not per-

formed. Patient made an uninterrupted recovery and was discharged, 31 days after admission.

Dr. Ross said that he was unable to make a diagnosis in this case because he did not properly credit the previous history of stomach indigestion. She had stated that she had had trouble with her stomach since the age of 7, a period of 61 years. The pain of her perforation has occurred 8 days prior to her admission and all her symptoms at that time indicated a partial intestinal obstruction without marked toxæmia.

CASE III.—Adult, female; admitted to the Germantown Hospital, February 11, 1914.

History.—Was seized 48 hours before with intense pain in the upper abdomen. She described this pain as resembling a knife going through her stomach. The pain came on about five o'clock in the afternoon, after she had eaten her dinner. The patient states that during the day she had worked very hard. She was treated outside from Monday night until Wednesday afternoon, when she was admitted to the hospital. She stated that for the last 10 years she has been having pain after eating. This would come on immediately after the taking of food. She would belch sour material and would frequently vomit; vomiting relieved pain. Was admitted to this hospital in the Spring of 1913 and operated on for uterine fibroids. Following this operation the patient's symptoms were not relieved. No history of gastric ulcer in family. The abdomen was markedly distended, with rigidity and marked tenderness. The rigidity and tenderness were most marked in the epigastrium.

The abdomen was opened in the midline, from the ensiform cartilage to the umbilicus. A large subdiaphragmatic collection containing pus, lymph and stomach contents was opened. The collection was to the left of the suspensory ligament of the liver. When this was cleaned out a perforation the size of a silver three-cent piece was discovered on the anterior wall of the stomach, about half way between the greater and lesser curvatures and 3 or 4 inches from the pylorus. The perforation was closed by a chromic catgut suture and reinforced by two layers of Lembert sutures of linen thread. Gastro-enterostomy was not performed. The subphrenic abscess was thoroughly drained by two rubber tubes and three cigarette drains. A glass tube was placed in the pelvis through a button-hole incision. This patient developed pneumonia, which was followed by an abscess of the left lung for which she was operated on by Dr. Francis T. Stewart, who stated that the abscess he opened was probably not the only one, as she continued to run some temperature.

CASE IV.—Male, age forty-two, admitted to the Germantown Hospital, February 28, 1914, about 2 A.M., suffering intense pain in the upper abdomen. Patient states that while at work lifting a heavy bar he was taken with a sudden pain in the epigastrium, which he described as feeling like being stabbed with a knife. Patient managed to get to a drug store where he was given some treatment by the druggist. A few minutes after the first dose he felt a little better and was then given a second dose. Following this he had intense pain which was sharp and excruciating, like the first. Before he left, the druggist gave him a dose of magnesium sulphate. He was suffering such intense pain that he was unable to get home, but managed to reach a cousin's house in Germantown where a doctor was called in. The doctor immediately washed out his stomach; a great deal of fluid was poured into the stomach but little removed. As the patient grew very much worse he was sent to the Germantown Hospital where a diagnosis of perforated gastric ulcer was made by the surgical resident, Dr. Williams, and Dr. Ross was notified and came out immediately and operated. White blood-cells were 24,000.

The patient had never been troubled with indigestion; never had pain before or after eating; always healthy. No history of gastric disturbances. Examination revealed a poorly nourished adult male, with abdomen markedly distended and rigid.

On opening the peritoneum, large quantities of gas and stomach contents escaped, including all three doses of medicine administered by the druggist, to say nothing of the washings of the doctor. Owing to the kindly ministrations of the druggist and doctor it was some time before the perforation could be located. It was finally discovered on the anterior wall, about one and one-half inches from the pylorus. The opening was closed as described in the other cases and a posterior gastro-enterostomy performed, because of some induration extending from the perforation to the pylorus, suggesting the probability of pyloric obstruction; also because the closing of the ulcer diminished the size of the pyloric end of the stomach corresponding to the area of the ulcer. The upper wound was drained by a cigarette drain to the site of the closed perforation and a counter drain by glass tube was placed in the pelvis to allow the various medicines, etc., to escape from the pelvis. For 18 days this man steadily improved; was on modified house diet and seemed to be getting well. Then he developed peritonitis which seemed to start in the lower abdomen. He died on the twenty-second day after operation, of general septic peritonitis. Unfortunately no postmortem was permitted.

CASE V.—Male, aged twenty-three; admitted to the Germantown Hospital, March 26, 1914.

History.—His trouble began on March 20, 1914, with feeling of malaise. On March 21, he got worse, had a chill and had to go to bed. He then felt better and got up. His nose bled yesterday (March 25, 1914). To-day he developed his abdominal soreness and pain in back of head and neck muscles. This evening he vomited. No nausea now. No appetite, very thirsty; bowels normal; occasional short dry cough, but this does not persist. He expectorates very thick tenacious mucus which is mixed with a sort of black blood. No pain in chest; no dyspnœa; feet never swell; no palpitation. Abdominal pain makes breathing very painful. Passes less urine than usual and it is dark colored and burns a good deal; no frequency.

Inspection of the abdomen revealed a few scattered minute pustules. One point suggestive of a rose spot was found. Tenderness over epigastrium. A little abdominal rigidity. No tenderness over McBurney's point. A mass is felt in upper left quadrant, extending about 6 c.c. below costal margin, presumably spleen. Abdomen tympanitic throughout. Audible peristalsis.

On the third day thereafter there was much more rigidity with a definite point of increased tenderness in the epigastrium. He now says that he has had pain occasionally for three years when hungry and this was relieved by eating. He had a sore throat the day before yesterday. Movable dulness elicited, suggesting fluid in abdomen. He cannot rest on his left side now, as it is too painful. Some blood, small amount, expectorated. Patient was transferred to surgical ward with a diagnosis of left side subphrenic abscess, probably due to perforating ulcer.

Operation on March 30, 1914, by Dr. Ross, assisted by Dr. Cope. A right rectus incision was made from costal margin extending downward along the border of rectus muscle—six inches long. On opening the abdomen quantities of pus escaped, which was carefully sponged away. On examination of stomach it was found distended, seemingly by gas, but none was seen to escape. Along the fundus was found a large, massive lymphatic exudate which extended upward over anterior surface, including gastrohepatic omentum and from gastrohepatic omentum upward, involving under surface of liver and posterior surface and lesser curvature of stomach. The finger was passed through gastrohepatic omentum and foramen of Winslow and a rough mass was detected on the posterior surface along the lesser curvature of stomach, which was taken to be a lymphatic exudate walling off the site of perforation. The different adhesions were broken up as well as it was possible to do so. On the left side of the suspensory ligament was found the abscess, which was directly underneath the diaphragm and between it and the liver. A cigarette drain was inserted directly to the right of the suspensory ligament to allow sufficient drainage of the subphrenic abscess. On the left two drains were inserted through the lesser omentum, one a cigarette drain and the other a rubber tubing, down to the site of perforation. The abdominal wall was then closed in the usual manner. As the abscess was definitely localized to the upper abdomen no drain was placed in the pelvis which proved to have been an error. The patient survived three days and then died of general suppurative peritonitis. The report of a partial postmortem follows:

The examination was of the abdomen and was performed through the incision made at operation for perforated gastric ulcer. The cadaver is one of an adult male, apparently thirty years of age, somewhat emaciated, with cheeks drawn and eyes sunken. Hair is normal; eyes, ears, and face show no special phenomena. The body frame is small and musculature is poor. Abdominal inspection: The abdomen presents an unhealed scar of the recent operation; and is flat, with little or no panicular adiposa and poor belly walls. Abdominal incision made by slightly enlarging the wound made at aforementioned operation. On inspection the whole abdomen presents the picture of a plastic suppurative exudate and older adhesions. This extends down into the pelvis and involves all the peritoneum. The pelvis contains about 20 c.c. of cloudy, flaky, serous fluid. The lesser curvature of the stomach is hemorrhagic; the gastrohepatic omentum shows a perforation about one inch in diameter; the entire upper abdomen is covered by a plastic exudate, while the jejunum and ileum are more free from this, but the great omentum is affected in the same degree with the upper abdomen. There is a bunch of small intestines firmly adherent in the pelvis. The appendix is normal. The cæcum and ascending colon are highly congested and firmly adherent to the wall. On section the stomach shows two small ulcers on the lesser curvature nearer the cardiac end; and one on the posterior surface which had perforated into the lesser peritoneal cavity. The duodenum is much degenerated and thin and presents one perforation about an inch in diameter on the posterior lateral aspect and still another about 2 inches in diameter on the anterior inferior surface. The lesser peritoneal cavity contained some fluid, while the peritoneum was markedly hemorrhagic. The wall of the duodenum is very thin in several places, having little more than the serous coat remaining. The liver and gall-bladder are normal. The kidneys are normal. The spleen is somewhat enlarged and shows hypertrophy of the lymphoid tissue. The intestines are congested throughout their entire length. No enlargement of Peyer's patches were found.

Summary of Findings.—1. Plastic and suppurative peritonitis. 2. Perforation into the lesser cavity. 3. Perforation in the duodenum. 4. Two ulcers on stomach mucosa nearer cardiac end.

The sixth and last case is the one in which the diagnosis is still in doubt, although the reporter was of opinion that it was a case of perforation of the stomach at the greater curvature on the posterior surface, in which there was erosion of one of the vessels running along the greater curvature accounting for the massive hemorrhage.

CASE VI.—Male, fifty-two years of age; there was nothing in his family history that threw any light on his case. He was a farmer and said he had been a little less strong than the average man of his class, not being able to lift so much. He had also been troubled with chronic dyspepsia and for some time past, when he leaned over, he had tenderness in the epigastrium. Two weeks ago, while at the dinner table, he had a pain in his epigastrium sufficiently severe to make him lie down. This continued during the afternoon, and although it continued through the night he obtained some sleep. The following morning at the breakfast table he had no desire to eat, and had an attack of excruciating pain so severe that it made him faint. When coming out of his syncope he vomited dark brown granular material resembling coffee ground vomit. He then sent for his physician who said the man had no rigidity at all of the abdominal muscles. He was tender in the right iliac fossa extending up toward the liver. The doctor wanted him to to go the hospital that day, but he did not come till the following morning, travelling some 40 miles. About 9.30 A.M. he was seen by Dr. Ross. His temperature was normal, pulse under 90; appearance rosy, lips pink; he had a leucocyte count of 11,000. There was absolutely no abdominal rigidity. He was tender, starting to the left of the median line at the epigastrium, going over to the right side and down to Poupart's ligament, dull in right flank and a little less dull in the left flank. There was no distention, but his belly felt full and doughy and a little dull to percussion. It was evident that he had a serious intra-abdominal lesion of some sort. Abdominal section was done at once. On approaching the peritoneum the bluish appearance of hemorrhage was seen. When the peritoneum was opened there gushed forth a tremendous amount of bright red blood, being more than in the ordinary case of extra-uterine pregnancy, followed by some thin, current jelly clot, while from the pelvis the clots were much darker and denser. The appendix was inspected and found normal. The small intestines were also normal as was the mesentery; the gall-bladder was normal. His gastrocolic omentum had an immense hæmatoma in it; between the layers of the transverse mesocolon there was another hæmatoma with a place in the left side which permitted the opening of his lesser peritoneal cavity in which was found some blood, and the posterior wall of the stomach, starting at the greater curvature, was infiltrated with hemorrhages.

The man is making a good recovery. A drain was introduced through the opening in the transverse mesocolon into the lesser peritoneal cavity and he is sitting up out of bed now, two weeks after operation, perfectly comfortable. An examination of his pancreas, made rather hurriedly because of his general condition, showed nothing abnormal. There was no evidence of effusion, no serum but comparatively fresh blood. The liver, so far as could be seen, was all right; hemorrhage from a pancreatic vessel would not explain the hæmatoma in the posterior layer of the stomach, nor would it account for the immense hæmatoma in the gastrocolic omentum. The veins around the stomach did appear very large but his conclusion was that the condition was due to a pin-point perforation at the greater curvature, going through the stomach wall and opening up one of the vessels on the greater curvature, the hemorrhage coming through the foramen of Winslow into the greater peritoneal cavity. The liver was not materially changed in size from the normal. There was an infinitely larger amount of blood in the greater peritoneal cavity than in the lesser.

This series presents several facts worthy of notice: Males, 4; females, 2; ages varied from 23 to 68. Time intervening between onset of symptoms and operation: longest period 8 days; shortest, about 11 hours. Of the two who died, perforation occurred about 6 days before operation. Of those recovering one had perforated 8 days before operation and in one two days intervened; in the third about 20 hours and in the fourth over 24 hours. Gastro-enterostomy was performed in two of the cases; one recovered (Dr. Deaver's case); one died (Dr. Ross' case). Site of perforation: Duodenum, 1; stomach, 3. Multiple ulcer of the stomach and duodenum with perforation of stomach ulcer and two perforations of the duodenal ulcers. The sixth case was gastric if the diagnosis of perforation is correct.

DR. MORRIS BOOTH MILLER reported the case of a man twenty-four years of age, who was admitted to the Polyclinic Hospital on January 22, 1913. He was taken suddenly ill with severe abdominal pain about five o'clock in the afternoon. Previous history was that he had had attacks of pain over the region of his stomach for a number of months, but for about a month before this accident the pain had been more severe and had recurred more frequently. He, however, had no vomiting at any time before the day he was stricken. The painful

attacks would occur about three hours after ingestion of food. He was constipated. When admitted to the hospital he presented that appearance which has been described aptly as one of abdominal tragedy, —sunken eye, pale face, anxious expression, with board-like, rather scaphoid belly, and tenderness marked in epigastrium and along the right flank. The operation in this case was performed about four hours after the perforation. As soon as the belly was opened the appearance of stomach contents and of gas was characteristic. The perforation was about the size of the end of a lead pencil and was situated about two inches beyond the pyloric vein and well over on the upper surface of the duodenum. On account of its depth it was difficult to catch and close, but he finally was able to close it with a double layer of sutures followed by a posterior gastro-enterostomy without a loop. The necessity of that procedure had come home to him through a lesson which he learned in a previous case, in which he was obliged to reopen to do a posterior gastro-enterostomy to cure a man whose pain and other symptoms persisted after a simple closure of the perforation.

Dr. John H. Jopson mentioned a case of perforation which developed a chronic lung abscess. Dr. Ross spoke of an acute lung abscess with drainage and recovery. In one case in which perforation had occurred some two weeks before he saw the patient and in which the attending physician had made a diagnosis of perforation, the perforation had eventually been walled off. At operation he found this condition—a subphrenic collection of cloudy fluid in the epigastrium, extending over the upper and under surface of the liver, which was covered with a thick fibrinous exudate. The perforation had been sealed over; it seemed to have been in the first portion of the duodenum. The area was drained, and in a short time the exudate broke down and the wound discharged thick pus. This diminished and the man was discharged with a sinus. A year later he died of brain abscess. At autopsy an old abscess was found at the base of the man's lung, adherent to the diaphragm. The pathologist's idea was that this abscess at the base of the lung was chronic, had antedated the perforation and was associated with pulmonary tuberculosis from which the patient suffered. Dr. Jopson was convinced that this infection had spread from below upward and resulted in a chronic abscess of the lung and that the brain abscess was secondary to that, and this in turn secondary to the perforation of the duodenal ulcer.

Dr. George P. Müller reported the following cases of perforation of the stomach and duodenum.

Case I.—Occurred in a woman, twenty-six years of age, who presented a history of symptoms suggestive of gastric ulcer. She was given a thorough treatment by an osteopath and shortly after complained of acute symptoms over the gall-bladder, tenderness, rigidity, and finally the appearance of a mass. There was fever and increased pulse rate. At operation at the Chester County Hospital, October 23, 1909, a large, perforated ulcer was found. It was carefully sutured and the site drained. Symptoms of pyloric stenosis gradually appeared and finally became so intense as to demand operation a year later, at which time a posterior gastrojejunostomy was done. The patient immediately began to gain weight and now is in perfect health.

Case II.—Man, aged forty, who gave a typical history of duodenal ulcer for six or eight months previous to perforation. The symptoms of the latter resembled appendicitis and he had marked tenderness over the appendix upon admission to the hospital. Temperature, 101.8°; pulse, 88; respiration, 32; leucocytes, 17,700. The operation (University Hospital, December 18, 1909) was performed thirteen hours after perforation. The appendix was first exposed and found congested, but as turbid fluid was seen running down from above a second incision was made and the perforation discovered, two inches from the pylorus. The perforation was rather large and was closed with a purse-string catgut suture, reinforced with a catgut mattress suture; drainage was introduced to the site of suture, to the kidney pouch, and through a stab wound to the pelvis. Ten days later a duodenal fistula appeared and discharged bile and pancreatic juice, greatly excoriating the skin. Accordingly, a posterior gastrojejunostomy was done through a second incision and in a week the fistula had closed. Patient was discharged 31 days after operation with the wounds practically healed.

Case III.—Man, aged fifty-five, without any previous history whatever of dyspepsia. He was suddenly seized with pain in the epigastrium and marked rigidity. There was tenderness over the gall-bladder region and the pain was referred through to the back. On admission to the hospital temperature was 98.6°; pulse, 90; respiration, 28. Perforated duodenal ulcer was diagnosed and operation performed three hours from the time of perforation at the University Hospital, July 12, 1910. A small perforation was found and closed with silk and the site of perforation drained. Patient was discharged five weeks after operation with wound entirely healed.

Case IV.—Admitted to the St. Agnes Hospital during 1912. She was a woman, thirty-five years of age, who for some time had

had dyspepsia and was then seized with pain followed by symptoms of peritonitis, although they were not recognized by the attending physician. She was sent in as a case of intestinal obstruction, about one week after the onset of symptoms, and the abdomen opened under local anæsthesia under that impression. A large perforation in the anterior wall of the stomach was found and also a general suppurative peritonitis. A rubber tube was sewed in to the perforation and nothing else done. Patient died in three hours.

CASE V.—Man of sixty-eight years who had suffered for some years from attacks of pain after eating and accompanied by belching. On April 20, 1912, he was suddenly seized with severe pain over the liver, radiating to the right shoulder, followed by vomiting and then by some distention of the abdomen. Temperature rose to 101° and remained about that figure. Vomiting continued and the distention increased; patient was never shocked and seemed bright and cheerful. Three days after the onset of symptoms he was seen by Dr. Müller, he was complaining of abdominal pain, mostly in the right iliac fossa, with persistent nausea and vomiting of black material. The abdomen was tightly distended. At operation (Presbyterian Hospital, April 23, 1912) there was found a very small perforation in the anterior wall of the duodenum. This was closed with linen and catgut reinforced by a tag of omentum. In addition he had a general purulent peritonitis, especially in the upper portions. The site of anastomosis was drained and the pelvis was drained, but the patient died twelve days after operation with symptoms of increasing toxæmia and perhaps of subphrenic abscess. We were not allowed to operate a second time and were not allowed to perform an autopsy.

CASE VI.—Man, thirty-eight years of age, who gave a vague history of previous indigestion. While at work he was suddenly seized with pain in the epigastrium, followed by vomiting, and on admission was extremely rigid in the epigastrium and had tenderness over the gall-bladder. Temperature was 99°; pulse, 100; respiration, 20; leucocytes, 20,700. The lesion was correctly diagnosed and the patient operated upon one and one-half hours from the time of perforation. At operation (Polyclinic Hospital, September 24, 1913) a small perforation of the anterior wall of the duodenum close to the pylorus was found. The perforation was closed and a posterior gastro-enterostomy performed and the site of perforation drained. A second drain was introduced to the pelvis. He was discharged in a few weeks with wounds entirely healed.

It will thus be seen that of the four cases which recovered, three were operated upon at a very early period and in the fourth, localization occurred, saving the patient. The reporter believes that a primary gastrojejunostomy should be performed if feasible, that is, if the operator is skilful enough to avoid extensive soiling of the peritoneal surfaces and if time is not an important element affecting the prognosis. It is interesting to note the almost immediate cure of a duodenal fistula by gastrojejunostomy.

In addition to these six acute perforations he had had two examples of what might be called chronic perforation.

The first occurred in a woman of twenty-two, with a typical history of ulcer, who was treated medically for some time with relief, but with recurrence. At operation (University Hospital, October 8, 1913) a duodenal ulcer was found which by reason of scarring and infiltration had produced some stenosis. In addition an ulcer of the posterior wall just below the lesser curvature had perforated the entire stomach wall, the infiltrated transverse mesocolon forming the base of the ulcer. The latter had almost perforated and, accordingly, the mass of infiltrated mesocolon together with the ulcer was excised. The wound in the stomach was closed and just posterior to it a no-loop gastrojejunostomy was performed in the usual manner. This patient seems to have made a perfect recovery. She had hemorrhage from the stomach two weeks after operation but recovered therefrom and is now doing well.

The second case was most interesting. It was in a man fifty years of age, who following an attack of dysentery began to suffer from pain in the upper abdomen which, during three years, gradually developed into a typical case of duodenal ulcer. At operation (University Hospital, November 19, 1910), a mass of adhesions was found in the region of the pylorus but no evidence of ulcer, although the pyloric end of the stomach felt thick and beefy and the duodenum was dilated. The adhesions were separated and the wound closed. Through a second incision a thickened constricted appendix was removed, the omentum being adherent. The patient improved and recovered from operation and for some time did well, but gradually the symptoms recurred, although there was some difference, as the pain was noticed more immediately after eating. After several years of medical treatment, a radiogram by Dr. Pfahler diagnosed a perforated gastric ulcer together with evidence of adhesions, etc. At operation at the Chester County Hospital, May 2, 1914, a perforated ulcer of

the posterior wall was found surrounded by a small mass of exudate which in turn was adherent to the pancreas. The ulcer and a portion of the stomach was excised and the wound closed. Because the operation took time and owing to the difficulty in separating the adhesions and the presence of much oozing, it was deemed inadvisable to perform gastrojejunostomy at that time.

CONGENITAL PERFORATIONS OF THE PARIETAL BONES

Dr. Penn G. Skillern, Jr. presented a calvarium, discovered in the dissecting room of the University of Pennsylvania, which presented a very rare condition, and one that would give rise to confusion clinically were its occurrence not borne in mind, namely, congenital perforations of the parietal bones. In a review of the subject in 1902, Piersol (*Univ. of Penna. Med. Bull.*, August–September, 1902) described and illustrated a case, and was able to collect but fourteen other specimens.

In this case (Fig. 11) the perforations are irregularly round, and very symmetrical as to size and position. Both occupy the centre of a depressed area, which readily transmits light (Fig. 12). The edge of each perforation is as thin as paper, and the surrounding bone increases in thickness until the periphery of the depressed area is reached.[1] On the right side the perforation measures 14 mm. transversely and 12 mm. anteroposteriorly, and readily admits the tip of the little finger. It is situated 3.5 cm. from the sagittal suture. On the left side the perforation measures 15 mm. transversely and 13 mm. anteroposteriorly, and admits the tip of the index. It is situated 2.5 cm. from the sagittal suture. Each perforation was filled in by the epicranium externally and the dura internally, both of which were inseparably blended.

These parietal perforations are probably due to an exaggeration of the local disturbance of ossification which ordinarily results in the formation of the normal foramina, induced by unusual intracranial pressure within the immature skull. Welcker and Toldt (*Spee. Skeletlehre, Bardeleben's Hands. D. Anat. D. Menschen.*, 1896, Band 1., S. 114, cited by Piersol) state that the normal development of the parietal foramina is closely associated with a cleft, usually about 5 mm. deep, on the mesial border of the young parietal bone. Within this cleft lies a perforating blood-vessel, commonly the emissary vein,

[1] Prof. Geo. A. Piersol, who examined this specimen, suggested that this progressive thinning represented an attempt at complete filling of the defect by ossification.

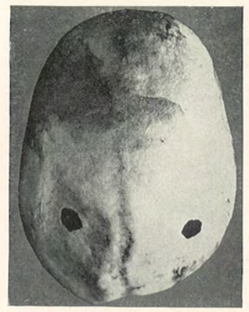

Fig. 11.—Congenital perforations of the parietal bones (external aspect).

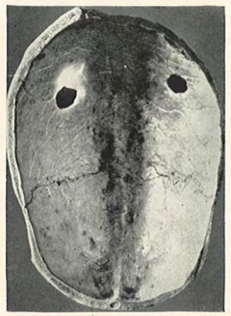

Fig. 12.—Congenital perforations of the parietal bones (internal aspect). Thinness of bone shown by light area behind left foramen.

which obstructs ossification at that point and causes the separation of the rays of developing bone. The subsequent closure of the fissure proceeds from the sagittal suture outward, the lateral or outer end of the cleft persisting as the parietal foramen. Piersol states that the generally recognized close relation between parietal perforations and parietal foramina admits of little question, especially when we consider the similarity of position, the symmetrical form and disposition of the apertures, as well as the observed gradual transitions from the large foramen to the huge hole.

Clinically, such perforations, were their occurrence not borne in mind, would cause confusion in palpation of the skull, in which the pulsations of the brain may be felt, in the examination of lacerated wounds of the scalp for underlying fracture of the skull; in the exposure of this area of the skull at operations; and in the examination of skiagrams of the skull.

STATED MEETING, MONDAY EVENING, OCTOBER 5, 1914.

The President, Dr. John H. Gibbon, in the Chair

MOWING MACHINE CUT OF LEGS

Dr. Edward B. Hodge presented a boy of three and a half years whose right leg had been nearly severed by the blade of a mowing machine. Both bones and the anterior tibial vessels and nerve, with the extensor muscles, were entirely divided. There was some laceration of the calf muscles next to the bones, but the posterior tibial vessels were not injured. Circulation in the foot was good. Under iodine sterilization the anterior tibial vessels were tied, the nerve sutured, and the ends of the divided muscles united as accurately as possible without unduly enlarging the incision and prolonging the operation. The child had lost much blood. The wound was dressed in a fracture box without drainage. Healing took place with slight discharge of serum, but no infection, and the boy has a perfectly useful leg. There is slight toe-drop and later it is probable that some further work will be needed on the muscles. There is a slight amount of sensation on the dorsum of the foot.

SARCOMA OF TONSIL

Dr. Ginsburg presented a man who had developed a growth in the right tonsil, the condition dating back to April of the present year. He had operated upon it in two stages; in the first operation, he removed the anterior palatine arch and the tonsil. Three weeks later, he made a dissection of the neck, removing the right submaxillary salivary gland, and all visible lymphoid tissue, finally ligating the external carotid artery at the bifurcation of the common carotid. A rapid recurrence has followed, and at present he is receiving daily treatments with radium, holding the tube containing the radium in his mouth for five hours at each sitting. Thus far he has received six radium treatments, and there is evidence of beginning resolution of the pathological overgrowth. The diagnosis is sarcoma of the right tonsil.

THE MORTALITY STATISTICS OF TWO HUNDRED AND SEVENTY-SIX CASES OF ACUTE INTESTINAL OBSTRUCTION

By John B. Deaver, M.D.
and
George G. Ross, M.D.
of Philadelphia

This study of the mortality statistics of intestinal obstruction is based upon a series of 276 consecutive cases of acute intestinal obstruction admitted to the German Hospital in the ten years ending with 1913. Some of the earlier histories were far from complete, and we have therefore used only those facts which could be found in practically all of the histories.

The etiology of the cases was as follows:

Post-operative adhesions		81 cases
Post-inflammatory adhesions		16 cases
Strangulated hernia		156 cases
Inguinal	77	
Femoral	50	
Umbilical	21	
Ventral	7	
Subdiaphragmatic	1	
Carcinoma of sigmoid		8 cases
Volvulus		5 cases
Fecal impaction		3 cases
Intussusception		2 cases
Adynamic ileus		2 cases
Congenital bands		1 case
Cause unknown or not recorded		2 cases

Of the 276 cases, 158 recovered and 118 died—a mortality of 42 per cent. One case is reported as improved, possibly one of the rare instances of spontaneous recovery or a mistaken diagnosis. The case noted as unimproved on the records probably declined operation and insisted upon discharge from the hospital.

A mortality of 42 per cent. in a large series of cases of acute intestinal obstruction is not an unusually high one. It is far higher than it should be, but an analysis of the records will easily disclose very definite reasons for such an unsatisfactory state of affairs.

In 241 cases we found adequate records of the average time from the onset of the condition to the time of operation. In the cases that

recovered it was 61.7 hours or over 2½ days, and in the case that died, 97 hours or 4 days and 1 hour. Under such conditions it is to be wondered at that so many cases had a fortunate outcome.

There is no doubt that in practically every instance, taking similar classes of cases, the time elapsing between the onset of the obstruction and the operation is the vital factor. Coley (*Keen's Surgery,* vol. iv, p. 50) states that in the first 24 hours the mortality in strangulated hernia should not be over 10 per cent.; in 72 hours it becomes 50 per cent. Naunyn (*Ibid.,* p. 645), in an analysis of 288 cases of ileus, states that recoveries within 48 hours were 75 per cent., but on the third day only 35 to 40 per cent. recovered. Pilcher (*Medical News,* 1902) reports 40 cases of acute intestinal obstruction due to gall-stones with a mortality of 52.5 per cent.

Da Costa (*Modern Surgery,* p. 976) states that mortality in acute intestinal obstruction is 60 to 70 per cent. and states also that prompt diagnosis and operation would much reduce this.

Ruge (*Archiv. f. klin. Chir.,* 1910–1911, xciv, pp. 711–760), in a report of Korte's Hospital cases of obstruction following appendicitis, reports a mortality of 50 per cent. in early obstruction, *i.e.,* immediately following upon the inflammatory process, and 45.8 per cent. in cases due to late or old adhesions. He reports in all 44 cases. J. V. Brown (*Surg., Gynec. and Obst.,* 1911, xii, p. 186) reaches the same conclusions as to the unnecessarily late operations in acute intestinal obstruction in a study of 59 cases in his experience. The only author whose experience seems not entirely to coincide with these facts is Woolsey (*Trans. Amer. Surg. Assoc.,* 1910, xxviii, p. 270), who in 26 cases of acute intestinal obstruction found that the average duration of the illness before operation had been rather less in the nine fatal cases than in the seventeen which recovered.

A more detailed analysis of the different groups of cases brings to light certain definite features concerning each group.

As to sex, our cases were divided fairly evenly, 144, or 52 per cent., being females, and 134, or 48 per cent., being males. Evidently complications arising from disease of the female pelvic organs slightly overbalanced the more frequent occurrence of hernia and disease of the appendix in the male.

Of special groups as regards etiology we find that hernias and post-operative and post-inflammatory adhesions furnish 253 of the 276 cases of obstruction.

There were in all 156 cases of strangulated hernia, or 56.4 per cent. of the total.

These were subdivided as follows:

Strangulated inguinal hernia	77
Strangulated femoral hernia	50
Strangulated umbilical hernia	21
Strangulated ventral hernia	7
Strangulated subdiaphragmatic	1

Of the 77 strangulated inguinal hernias, 57, or 74 per cent., recovered, and 20, or 26 per cent., died. Of the 50 cases of strangulated femoral hernia, 36, or 72 per cent., recovered, and 12, or 24 per cent., died. One was noted as improved, possibly spontaneous recovery or reduction; and one is noted as unimproved.

Of the 21 cases of strangulated umbilical hernia, 12 recovered and 9 died, or 42 per cent. Of the seven ventral or incisional hernias, 4 recovered and 3 died, or 42 per cent.

The higher mortality in the umbilical and ventral hernias is accounted for by the frequently observed fact that acute symptoms are often delayed and of lesser severity than in the inguinal and femoral hernias, and the indications for operations not quite as early and definite as in the other varieties of hernia.

Nevertheless, such a mortality in strangulated hernias is appalling. It is true that the average operation for an early strangulated hernia of any of the ordinary varieties does not offer great technical difficulties nor should it be attended by great mortality. The explanation is again to be found in delay before operation. It is our practice at the German Hospital to operate strangulated hernias as soon as possible after admission; the delay, therefore, as in all cases of obstruction admitted to hospitals, is before the admission of the patient. In some few instances the patient may be slow to consult a physician, but generally this is not the case.

In hernia especially the physician has a clue and guide to the cause of the symptoms in the very existence of the hernia. Oversight must be rare, except, possibly, in instances of Richter's hernia. But the hernia, while plainly indicating the source of trouble, also opens the way for delay in the operative treatment of the obstruction by giving an opportunity for an attempt to correct the condition by taxis and manipulation.

Coley gives five minutes as a safe length of time to employ taxis. Many indeed of our cases at the German Hospital have, before admission, been subjected to manipulations, often severe and inexpert, extending over many hours and even repeated upon successive days.

When we consider the dangers and difficulties of taxis in strangulated hernia and bear in mind the fact that manipulation has been resorted to in practically every case before its admission to the hospital, we are justified in making it our practice to operate at once upon every strangulated hernia regardless of any other considerations. When ether or chloroform anæsthesia are not safe, local anæsthesia, and in rare cases spinal anæsthesia, will enable us to overcome this difficulty.

Although in our statistics we coincide with Coley in stating that the highest mortality in strangulated hernias is in the umbilical and ventral, our mortality in strangulated inguinal hernias (26 per cent.) was slightly higher than that of the femoral (24 per cent.), the reverse of what this author states. We are also able to substantiate his statement that the mortality is in large hernias and when the sac contains adherent omentum, and we believe that these two factors common to umbilical hernias are important in contributing to the high operative mortality in these cases.

Next to hernia in number are post-operative adhesions, there being in our series 81 cases, or 29 per cent., of the total number. Of the 81 cases, 41 recovered and 40 died, a mortality of 49.3 per cent. This mortality also is high and can only be accounted for by the long average time elapsing between the onset of the disease and operation. While the symptoms of strangulation of a femoral or inguinal hernia are fairly well known to the physician, it would seem that in other cases of intestinal obstruction terminal symptoms only are recognized. It is true that usually a case of obstruction has been diagnosed as colic, acute gastritis, or enteritis, and that a diagnosis of intestinal obstruction is not made until we begin to have the symptoms of toxæmia, peritoneal inflammation and persistent vomiting, often fecal.

In a small percentage of the cases the obstruction occurred during convalescence and while the patient was still in the hospital, when the diagnosis could be made early and treatment promptly instituted. The average time from the first operation to the obstruction was two years and three months. The longest period intervening was twenty years (following a hysterectomy).

Of the 81 cases of post-operative adhesions, 51 followed operations for appendicitis and 44 of this series had had drainage at the original appendiceal operation. Each drainage case can safely be held to mean a case in which operation was delayed beyond the time of election. In line with endeavors to prevent instead of treating avoidable surgical conditions, nothing is more important than to forestall the development of pus within the peritoneal cavity. Of the 51 cases, 27 died. A large

percentage at least of these patients would never have had adhesions or the consequent obstruction had they been operated upon early in the appendiceal attack and had drainage not been necessary.

Seventeen cases are stated to have been due to post-operative adhesions, the primary cause not being given.

Fourteen followed operations upon the female pelvic organs, hysterectomies, salpingo-oöphorectomies, etc. A certain number of such cases are now doubtless avoided by the greater care exercised in covering raw surfaces, stumps, etc.

Post-inflammatory adhesions were 16 in number. The term is used to designate new adhesions from an inflammatory or peritonitic process. Of these 11 died, a mortality of 68.7 per cent. This is partly due to the weakened and septic condition of the patients at the time of operation and partly due to the difficulty of diagnosis. Our results must always be in question in these cases. Our only hope is in minimizing the cases of peritonitis and of resulting obstruction. Most of such cases occur after operation for appendicitis in its later stages.

A more difficult post-operative condition to explain is adynamic ileus, of which there were 2 cases, one recovering and one dying. In the absence of a septic cause excessive handling of the viscera may be held to account for it. A more probable explanation is the occurrence of a thrombosis of the mesenteric veins.

There were three cases of fecal impaction with two deaths, a mortality of 66⅔ per cent. Fecal impaction generally occurs in elderly people and often much time elapses before operation. The onset and course are more or less insidious and the patients have usually been treated vigorously by purges, starvation, enemata, etc. Moreover, operative intervention very occasionally leads to enterostomy and colostomy, and this in itself is an unfavorable factor. One case of acute obstruction is recorded as having been caused by congenital bands. Of late years so-called "congenital" bands have received an increasing amount of attention. We believe that bands of extent great enough to produce obstruction are rarely congenital—that they are practically always due to subacute or unrecognized attacks of peritonitis.

There were five cases of volvulus, of which three recovered and two died, or 40 per cent. This is a condition not very frequent and generally not definitely diagnosed before operation. The sudden onset and rapid development of symptoms, however, are always sufficient to make clear the fact that some abdominal catastrophe demanding surgical intervention has occurred.

The same is true of intussuception in adults, of which there were

two cases in this series; one recovered and one died. The case which recovered was a most interesting one. The intussusception occurred during typhoid fever, was correctly diagnosed and promptly operated. It has been elsewhere reported by one of us in conjunction with Dr. H. F. Page (*Amer. Jour. Med. Sci.*, December, 1907).

There were eight cases of acute obstruction complicating carcinoma of the sigmoid. It is not to be expected that in such cases recovery could occur.

Taken as a whole, numbers of cases in which adequate records were kept show certain interesting points in symptomatology. In 63 cases, from 1908 to 1912 inclusive, with records of the vomiting, there were 35 recoveries and 28 deaths. In the cases recovering 5 only had reached the stage of fecal vomiting, but the average length of time the patients had been vomiting was two days and one hour. Of the 28 cases dying, 14 had fecal vomiting and 14 non-fecal vomiting only. The average duration of the vomiting had been two days and sixteen hours.

It would seem almost impossible that a patient with persistent uncontrollable vomiting with other symptoms of obstruction should be allowed to continue ill for over two days without a diagnosis or appropriate treatment.

In ninety cases, 1908 to 1912 inclusive, in which a record was kept of the fecal evacuations, 52 were cases that recovered and 38 died. In the recovered cases bowel movements had been absent on an average for two days and twelve hours and in those that died, three days and five hours. These figures point, as do the previous ones, to inexcusable delay, for in practically every case vigorous means had been adopted to produce an emptying of the bowel. Here we may well sound a note of warning against misinterpreting evacuations of the lower bowel only as a result of enemata, especially when the colonic contents are emptied by a high enema.

A review of the entire mass of statistics upon this series of cases makes it evident that in almost every instance, in spite of symptoms so plain as to be pathognomonic, diagnosis has been tardy and operation delayed. Prompt diagnosis and immediate operation will reduce the mortality in acute intestinal obstruction to a mere fraction of that encountered at present.

Dr. Charles H. Frazier said that one of the most important life-saving factors in the management of cases of intestinal obstruction is the avoidance of a general anæsthetic, particularly ether. These patients are intensely toxic and do not stand an anæsthetic well. The greater part

of the operation can almost always be conducted under a local anæsthetic, and at most a few whiffs of nitrous oxide may be required to allay pain.

Dr. John H. Gibbon said that there are two elements in the mortality of strangulated hernia or intestinal obstruction: One is the anæsthetic, already mentioned by the authors and in discussion. General anæsthesia should be avoided whenever possible, in the hernia cases especially. If a general anæsthetic is used, it should be as short a period of general anæsthesia as possible. Not only because of the bad effect of the anæsthetic upon the patient, but because the man who is operating under a general anæsthetic is tempted to do a great deal more than if operating with a local anæsthetic. It is trying to complete an operation that often results in the death of these patients. This is particularly true in regard to colonic obstruction. When the patient is anæsthetized it is easy to make the mistake of trying to do too much instead of simply trying to relieve the obstruction, and doing the radical operation at a later stage.

Another point is that of post-operative obstruction—a condition the frequency of which has greatly diminished in recent years. This difference is due to the fact that we are not packing abdomens full of gauze, and that drains are covered with rubber to prevent adhesions.

Dr. Ross, in closing, said that the technic carried out is a very simple one. As a rule, a general anæsthetic is used; infrequently, a local anæsthetic. The anæsthetic is given to the degree that obstetricians give it, enough to dull the patient's sensibilities. The abdomen is rapidly opened with a liberal incision and evisceration done at once. No attempt is made to locate the obstruction. The entire small bowel is delivered and laid upon a wet towel. At once the obstruction comes into view and it is dealt with according to the condition of the bowel and condition of the patient. If the patient is profoundly toxic, enterostomy is done and the wound sewed up. If the patient's condition warrants it, resection is attempted when the bowel is badly damaged, but as a rule the intestines are put back at once, salt solution used, drainage instituted, and the wound sewed up. Paul's tubes we rarely use to drain the bowel. Occasionally, but rarely, the bowel is fastened to the anterior abdominal wall for the purpose of permanent drainage.

Post-operative adhesions are diminishing in frequency. It used to be, five, six or seven years ago, that one patient out of eleven coming to the German Hospital with appendiceal abscess and drained with the method employed at that time, of large folds of iodoform gauze, had

post-operative obstruction. This is not so to-day, because a different method is used. Rubber tissue is used to protect the capillary drains and prevents adhesions.

TRAUMATIC RUPTURE OF THE DEEP URETHRA

Dr. George G. Ross presented a boy, aged eleven, who was run over by a heavy wagon, the wheels passing diagonally over the right lower abdomen, pelvis and left hip, at 7.30 P.M., April 21, 1914.

On admission the boy was shocked and in great pain; temperature remained subnormal until the following morning. Pulse was weak and thready and rose to 144 by the following noon. Examination revealed a bruised abdomen and hip, and in addition a fracture of the left tibia in the upper third. The patient's chief complaint was rectal pain. No urine was voided from 7.30 P.M. until the following day. Shortly before noon the day after the accident the patient was catheterized. Before this had been done some blood was noted at the meatus. The first use of the catheter brought a few drops of blood and later one-half ounce of bloody urine. There was great abdominal and perineal tenderness and swelling in the perineum. At 2.15 P.M., on April 22, hypodermoclysis was given and strychnine ordered. Dr. Ross saw the patient at 4 P.M. and concluded that operation was inadvisable because of the patient's general condition.

In the next few days the abdominal rigidity lessened and catheterization was possible. A retention catheter could not be employed because of the discomfort caused. The patient's general condition improved, the pulse, however, remaining very weak and there being always much abdominal pain and tenderness. An X-ray showed a fracture of the descending ramus of the left pubic bone. The patient began to void urine fairly well four or five days after the accident, often involuntarily, and had involuntary bowel movements.

On April 27, the sixth day, he became very restless and began to run a septic temperature. Examination revealed a lower abdominal resistance with tenderness suggesting urinary extravasation, and operation was decided upon. On April 28, 1914, one week after the accident, a suprapubic incision was made and the space of Retzius opened. A large quantity of ammoniacal urine was evacuated. The broken portion of the pubis could be easily felt, but evidently had sprung back partly into place. A catheter (silver) introduced showed its tip through a rent in the bladder just at the site of the urethral junction—or the site of the urethral avulsion—and could not be introduced into the bladder proper. Drainage tubes were introduced and allowed to remain a number of days. The temperature was septic for a week, and mildly febrile for a week, and then from the third to sixth week septic, but not severely so. All urine came through the suprapubic wound. Several attempts at catheterization were failures. On May 27 a deep gluteal abscess was opened by his assistant, Dr. Mencke. It was a hard abscess with little pus that had been extremely painful and evidently caused by deeply burrowing urine. The suprapubic wound showed great tendency to close and the discharge of urine was impeded. This gave the patient great pain. The incision was again enlarged on May 27, but an attempt to pass the catheter was unsuccessful.

Finally, these closures exhausted the patient so much that on June 9 under ether anæsthesia he attempted catheterization, and was successful in introducing first a silver catheter and then a 10 English woven catheter, which was sewn in and remained five days. The suprapubic incision was cleaned of old granulations. The former bladder rent was not felt. The catheter remained in five days and since then the patient voids naturally. No urine has come out above since the last operation.

Dr. Gwilym G. Davis said that, in cases of rupture of the urethra in the membranous portion or in close connection with the bladder, difficulty is often experienced, as in this case, of passing the catheter into the bladder. Some years ago he was visiting in the country and he was asked to see a man who had sustained a rupture of the urethra from falling astride a board. There was no external wound at all, and the endeavor to introduce a catheter by the usual method was a failure. He therefore injected warm water into the urethra through the meatus, which distended the urethra and also the parts at the site of the injury. He then took up a large metallic catheter and with ease passed it across the broken part into the bladder. He suggested the method as worthy of trial in such cases.

COMPLETE FRACTURE OF THE LOWER THIRD OF THE RADIUS IN CHILDHOOD, WITH GREENSTICK FRACTURE OF THE ULNA

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While fractures of both bones of the forearm in childhood are frequent and well-recognized, there is one variety that, in its mechanism, site, and characteristics, is as definite a clinical entity as is Colles's fracture, and yet it has not been differentiated in the text-books or in the literature from the other indifferent fractures of the forearm. I refer to complete fracture of the radius with incomplete greenstick fracture of the ulna in the lower third of their shafts (Fig. 1). The cause is quite constantly a fall *while in motion,* most commonly either off skates or a bicycle. The deformity consists of displacement of the lower fragment of the radius to the dorsum and laterally, and bending of the ulna with concavity toward the radius, the radial portion of the fibres of the ulna at its site of fracture being compressed but not torn asunder, the inner fibres only being separated. I shall endeavor to show that about this peculiar and characteristic incomplete greenstick fracture of the ulna hinges the maintenance of the displacement, and also the correct method of reduction. The following two cases are typical:

Case I.—H. H., male, aged fourteen years, school-boy, white, presented at the Surgical Out-patient Department of the University Hospital (Case record 40,201) on April 2, 1914, with the history of having fallen two days previously, *while skating,* upon the outstretched right forearm.

Clinical Diagnosis.—Fracture of radius and ulna shafts, lower thirds, that of the radius being complete and with displacement, and that of the ulna being incomplete and with diminution of the normal external concave curve. Skiagram showed for the radius in the anteroposterior view a transverse dentate line of fracture 1⅛ inches above the epiphyseal cartilage, with lateral shifting of the distal fragment, one-third diameter; and in the lateral view, displacement of the same fragment dorsally, two-thirds diameter; and for the ulna a transverse greenstick line *incomplete externally,* at a higher level (⅞ inch) than that of the radius, and with bowing of the ulna concave externally (Figs. 1 and 2).

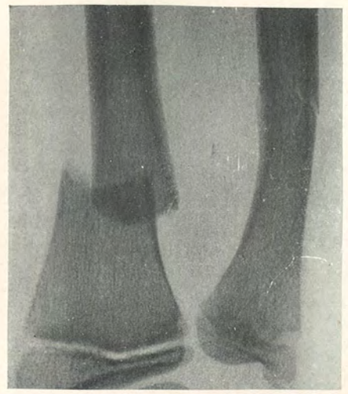

Fig. 1.—Type of "special" fracture of radius and ulna (anteroposterior view). The radius is involved by a transverse dentate line, 1⅛ inches above the epiphyseal cartilage. The distal fragment is shifted laterally, one-third diameter. The ulna is involved by a transverse greenstick line, incomplete externally, at a higher level (¾ inch) than that of the radius, and with bowing concave externally. See Case I.

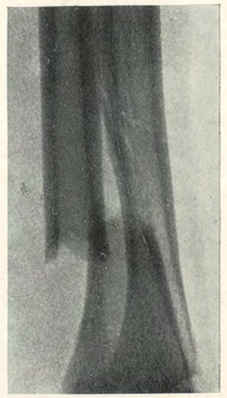

Fig. 2.—Lateral view of radius and ulna in Case I. The distal fragment of the radius is displaced dorsally, two-thirds diameter. There is slight dorsal displacement of the ulna.

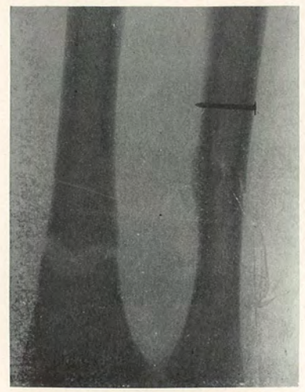

Fig. 3.—After reduction (anteroposterior view). Note complete rupture of outer fibres of ulnar fracture, with consequent straightening of inner border of ulna and automatic shifting of displaced distal fragment of radius into good position. Compare with Fig. 1.

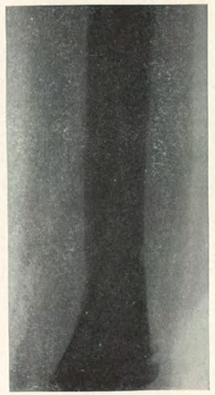

Fig. 4.—After reduction (lateral view). Fragments reduced to their normal position. Compare with Fig. 2.

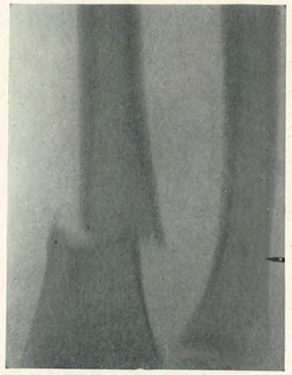

FIG. 5.—A second typical case of "special" fracture of radius and ulna (anteroposterior view). The description corresponds to that of Fig. 1, although both bones are fractured at a more distal (⅛ inch) level. By placing a ruler along the inner border of the ulna the outward bowing of this bone, distal to the seat of fracture, is accentuated. See Case II.

FIG. 6.—Lateral view of radius and ulna in Case II. Note dorsal displacement of distal fragment of radius, ½ diameter, with greater angulation than in Fig. 2. No displacement of ulna.

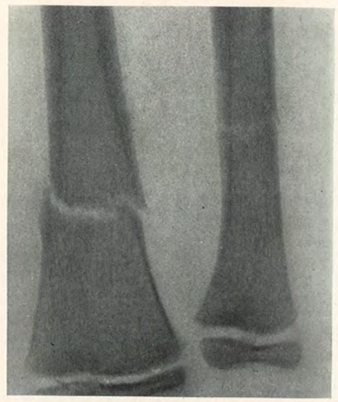

FIG. 7.—After reduction; anteroposterior view. Again the outer fibres of the ulnar fracture have been completely ruptured with the result that the alignment of the inner border of the ulna has been restored and the displaced radial fragment shifted into place. Restoration of alignment of inner border of ulna may be demonstrated by a ruler. Compare with Fig. 5.

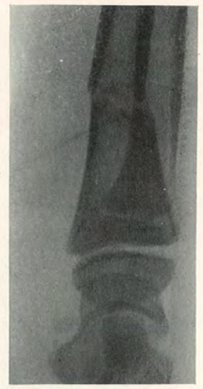

FIG. 8.—After reduction; lateral view. Distal fragment of radius still angulates slightly backward, but this was corrected with ease at the next dressing. Compare with Fig. 6.

A study of this fracture in the skiagram not only reveals the mechanism of production, but also furnishes a clue to the mechanism of reduction. The deformity leads one to anticipate difficulties in complete reduction, but it is very simple. In the first instance, it is evident that the brunt of the vulnerating force was borne by the radius, whose fracture is complete, and that there was sufficient force remaining to produce the greenstick fracture of the ulna. The inner fibres of the ulna were ruptured by tensile stress, whilst the outer fibres underwent compressive stress, the force thus stopping short of causing a complete fracture of this bone. *These intact outer fibres of the ulna maintained the position the bones were in when the force ceased to act, and therefore presented the chief obstacle to reduction.* It is patent that *in order to reduce the fracture, attention must be directed chiefly toward overcoming the vicious bowing of the ulna, and that this can be accomplished only by rupturing the still intact outer fibres,* so that alignment of the inner border of the ulna may be restored, which means conversion of the greenstick into a complete fracture. This having been done, *the radial fragments, aided by a little pressure, will reduce themselves automatically.* Acting upon this analysis of the fracture, the complete reduction of the fragments, as shown in the second skiagram (Figs. 3 and 4), was attained. The criterion of reduction, then, must be the restoration of the alignment of the inner border of the ulna.

CASE II.—H. M., male, aged thirteen years, school-boy, white, presented at the Surgical Out-patient Department of the Hospital of the University of Pennsylvania (Case Record 41,221) on July 22, 1914, with the history of having tripped five days previously down three steps, turning a somersault, and landing upon right forearm.

Clinical Diagnosis.—Complete fracture in lower third of radius with displacement, and greenstick fracture of ulna at a slightly higher level. Skiagram showed for the radius in the anteroposterior view (Fig. 5) a transverse dentate line one inch above the epiphyseal cartilage, with displacement of upper end of distal fragment laterally, one-third diameter, and in the lateral view (Fig. 6) displacement of upper end of distal fragment dorsally one-half diameter. The ulna showed in the anteroposterior view a transverse greenstick line 1½ inches above the epiphyseal cartilage, *incomplete externally,* and slight bowing of distal fragment with concavity toward radius. In the lateral view there is no displacement.

Under nitrous oxide gas anæsthesia the greenstick fracture of the ulna was made complete, the outer, unbroken fibres rupturing

with an audible snap. The fragments of the radius adjusted themselves automatically into place. Two splints were applied, a volar bond and a dorsal straight, and the forearm was placed in a triangular sling. Skiagram (Figs. 7 and 8) showed that reduction was complete, *the alignment of the inner border of the ulna having been restored.*

This case was so similar to the first case in the mechanism of production, the findings, and the mechanism of reduction, that I looked over our records to gauge its frequency. A study of these previous cases, together with a closer investigation of cases reporting subsequently forced me to the conclusion that here *we are dealing with a fracture fully as characteristic and significant as Colles's fracture in adults.* In other words, this fracture is to childhood what Colles's fracture is to adults. Colles's fracture is comparatively rare in childhood, having been found in but four per cent. of cases in this series, and occurs at an older age than fracture of both bones in their lower third.

Malgaigne recognized that greenstick fractures are more common in the forearm than elsewhere, and are usually due to a fall upon the hand. The importance of reduction is exceptionally great, not only from the stand-point of epiphyseal growth, but also from that of rotation of the radius, which may be easily destroyed by displacement or non-union. The teaching that a bad anatomical result does not always imply a bad functional result is baneful, for it furnishes an excuse to be satisfied with inferior anatomical reduction. On the contrary, the idea expressed by Mr. Robert Jones, of Liverpool, that a bad anatomical result gives good functioning in only 29.7 per cent., but that a good anatomical result gives good functioning in *90.7 per cent.* of cases, is to be endorsed. The same authority also advises that, in addition, the bones be restored to their normal curve. Despite these strong arguments in favor of completing incomplete fractures so as to restore proper alignment, there are some, Cotton among others, who consider it unnecessary, and that it makes it harder to maintain the fragments in the correct position. To this there may be added the theoretical objection that the periosteum might be ruptured or torn up, and that osteoblasts might grow along the blood clot out into the muscles, produce exuberant callus, and subsequently interfere with function. These objections may be met with the observations that many fractures are complete from the beginning, and often show considerable displacement, as in the radius in my case, yet healing without exuberant callus results; that in childhood the periosteum is thicker and tougher than in adults, and hence less liable to be torn; and that, when properly reduced, it is not hard to maintain the

fragments in the correct position—not even so hard as when the fractures are complete from the beginning, since the grip of the greenstick fracture, together with the unruptured periosteum, tends to prevent wide excursion of the fragments from each other during reduction. Of course, in fractures as well as in luxations, it is inadvisable to use an undue amount of force in the act of reduction, for extensive damage might be done.

Analysis of Cases.—One hundred cases of fractures of the radius and ulna in childhood in which the histories were carefully kept were selected from the records of the Surgical Out-patient Department of the University Hospital between January 1, 1912, and September 1, 1914, and afford a fairly rich assortment for study.

Season.—Sixty per cent. occurred in the summer months, from May to August, inclusive. In the Spring, bicycles, skating and running become popular. In June and July young human beings revert to the type of their arboreal ancestors coincident with the appearance of luscious cherries upon trees. With the opening of public playgrounds falls from swings furnish many cases. Twenty per cent. occurred in each of the remaining periods of four months, sledding being a contributory factor.

TABLE I

TABLE SHOWING FREQUENCY ACCORDING TO MONTHS AND SEASONS

January	3	May	10	September	8
February	6	June	10	October	6
March	5	July	28	November	4
April	6	August	12	December	2
Total	20		60		20

Age.—More than two-thirds occurred from nine to fourteen years of age, inclusive. This is the period of greatest and roughest activity in childhood. Both bones and the ulna alone were broken in younger children, while fractures of the radius alone or disjunction of its lower epiphysis occurred on an average in older ones.

TABLE II

TABLE SHOWING FREQUENCY ACCORDING TO AGES

2	1	9	13	15	4
3	3	10	7	16	3
4	3	11	11	17	4
5	1	12	13	18	0
6	5	13	11	19	1
7	4	14	14		
8	2				
Total	19		69		12

Sex.—Four-fifths of the cases occurred in boys, in keeping with their rougher methods of play.

TABLE III

TABLE SHOWING FREQUENCY ACCORDING TO SEX

Males	81
Females	19

Cause.—Fractures of the upper extremity in general and the forearm in particular are the penalty of the erect attitude, and of atrophy of the prehensile function of the forelimb. It seems best to distinguish two classes of falls, those with which momentum is strongly associated, and those in which it is an insignificant factor, the attraction of gravity predominating. In the latter class falls from a height may be given special prominence. A study of these cases shows that the special fracture of the lower third of the radius and ulna, the basis of this paper, is particularly associated with the momentum gained by bicycling, skating, swinging, running, horseback-riding, motoring, and pole-vaulting. Those in which the force is more purely the attraction of gravity are falls from steps, porch or fence rail, chair, bed, high-jump, or merely slipping and falling upon hyperextended, less often hyperflexed, hand. Falls from a height include those from a tree, pole, ladder, or haystack.

Site.—As in adults, the lower third of the radius is most frequently fractured. In this series the lower third of both bones or of the radius alone comprised 70 per cent. of the fractures. This circumstance and the fact that the radius in childhood is usually fractured above Colles's site (which is usually taken at from one to one and one-half inches above the lower articular surface of the bone) may be explained in part by the statement of Rixford (*Jour. A. M. A.*, 1913, lxi, 916), that in the long bones of children the medullary canal is smaller than in adults and is especially undeveloped toward the ends, and that the compact bone of the shaft becomes thin much farther from the ends than in adult bones and the cancellous bone extends correspondingly farther from the epiphyses. The following table has been compiled to show the mechanism according to the site of fracture.

The most significant feature of this table is the frequency with which the radius and ulna are both fractured in their lower third, this site being involved in 32, or almost one-third of the cases. Of these 32 cases, thirteen, or almost 50 per cent., conform to the type to which special attention is called in this paper, namely, complete fracture of the lower third of the radius with dorsal and lateral displacement and green-stick fracture of the ulna incomplete on its radial side and with bowing

TABLE IV

TABLE SHOWING MECHANISM ACCORDING TO SITE OF FRACTURE (See Figs. 9–13)

No. Cases	Site	Gravity Without Momentum	Gravity With Momentum	Falls From Height	Cause Not Given
4	Both bones, upper third	3	1	0	0
14	Both bones, middle third	7	6	0	1
32	Both bones, lower third	15	11	6	0
6	Radius, lower third, and ulna, styloid	2	2	0	2
3	Radius, upper third (neck 2, shaft 1)	2	0	0	1
3	Radius, middle third	1	2	0	0
16	Radius, lower third	9	4	2	1
16	Radius, disjunction of lower epiphysis, and fracture of ulna, styloid tip (2)	5	4	3	4
6	Ulna	4	1	1	0
100		48	31	12	9

of the lower fragment of the ulna over toward the radius, the displacement of whose lower fragment it thus maintains. In fact, *this special fracture comprises 13 per cent. of all fractures of the radius and ulna*

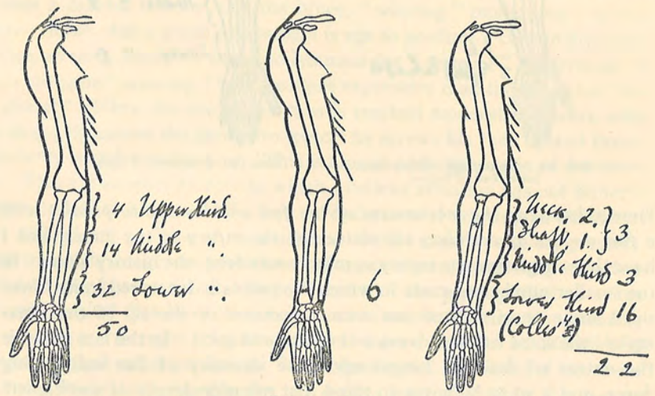

FIG. 9.—Fractures of radius and ulna (thirds).

FIG. 10.—Fracture of radius (lower third) and ulna (styloid process).

FIG. 11.—Fractures of radius (thirds).

in this series. Of these thirteen special fractures at least eight, or almost 66 per cent., were caused by gravity *with* momentum. In the remaining five the nature of the fall unfortunately is not stated in two, was direct

violence in two others, and a fall from a ten-foot ladder in the remaining case. Hence, it may be stated that this special fracture is typically *the resultant of the action of gravity with momentum.* A study of the non-typical fractures at this site shows in a general way that falls upon the hyperflexed hand are apt to result in " buckling " fracture of both bones, by which is meant telescoping of cancelli with bulging about the circumference of the fracture and without displacement; that falls upon the hyperextended hand are apt to result in ordinary greenstick fractures of both bones with angulation, and that falls from a height are apt to produce complete fractures of both bones with greater displacement.

FIG. 12.—Epiphyseal disjunction, lower end of radius.

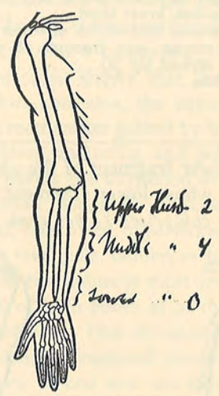

FIG. 13.—Fractures of ulna.

Hence, *knowing the mechanism of the fall enables one to predict with a fair degree of certainty the nature of the injury to the bones,* and I have thus diagnosed the injury in many cases from the history alone. In the smaller number of cases in which the radius is fractured in its lower third alone or in conjunction with separation of the tip of the ulnar styloid the same rules of cause and effect hold good. In the last analysis the extent of fracture hinges upon the intensity of the vulnerating force, and it must be borne in mind that minuter details of mechanism could be elicited if the observer were to see the patients actually falling.

In the sixteen cases of disjunction of the lower epiphysis of the radius all these mechanisms were exemplified. This injury occurs on an average at a later age than the fractures we have been discussing. It is diagnosed clinically by the site of the displacement, if any exist. There

may have been displacement which was reduced by the patient, in which case the history is of great diagnostic importance, and the skiagram being negative is really of positive value. In two of these cases the tip of the styloid process of the ulna was avulsed. There was one case of para-epiphyseal strain, in which injury the epiphysis is partially separated, and one of para-epiphyseal sprain, in which the epiphysis is completely separated but not displaced. These types of injuries conform with the well-known classification of Ollier, and may be diagnosed by the site of " wincing " tenderness, the absence of deformity or of history of deformity, and the skiagram, which shows a widening of the epiphysis, and later on callus formation about the site of injury. Epiphyseal injuries must always be suspected in children and adolescents and carefully reduced and treated just as a fracture, lest there arise deformity in the growth of the bone.

The diagnosis of an injury to the forearm should always be made by careful clinical investigation. It is a great mistake in more than one way to depend exclusively upon the skiagram. *A skiagram must be considered merely as one of the many signs of fracture.* There are two factors which will diagnose 90 per cent. of fractures of the forearm clinically. One is a thorough understanding of the mechanism obtained from a careful history, and the other, " wincing " tenderness. It has been shown that a given mechanism is apt to produce a certain fracture. This, in turn, indicates where to examine for " wincing " tenderness. I use the term " wincing " because more expressive than the adjective " localized." When the site of fracture is reached moderate pressure with a finger tip causes the patient to *wince:* he screws his face up and involuntarily withdraws his arm. This is almost pathognomonic of fracture.

There is another feature to which I believe attention has not hitherto been called. I have recently seen several cases of fracture in childhood in which I was positive of the existence of a fracture on clinical grounds, but in which skiagrams taken from all aspects were apparently negative. Not having been satisfied I decided to await the usual period of callus formation and then have other skiagrams taken, in the meantime treating the cases as fractures. In these several cases I had the satisfaction of seeing typical callus produced. In the first case I wondered if this were a traumatic osteoperiostitis, but my doubts were allayed by the second case, in which there was a complete fracture with callus in the lower third of the radius while the ulnar callus showed only along the radial border of this bone, at a location where it is obvious that traumatic osteoperiostitis could not occur, especially seeing that the injury was produced by indirect violence. Minute scrutiny of the skiagrams now

revealed a very faint transverse line, perhaps only a few torn cancelli, whose site corresponded exactly to that of the clinically-elicited " wincing " tenderness (Fig. 14). In interpreting this faint line defects in the plate were carefully excluded. I believe that here we are dealing with the first degree of a greenstick fracture—a degree attained by the vulnerating force ceasing to act after it had torn a few cancelli, whereas further action of this vulnerating force would have produced the typical bending greenstick fracture. These cases also emphasize the accuracy of " wincing " tenderness, and its value as an indicator of where to look on the skiagram for a fracture. I believe I present good reasons for considering a skiagram a secondary sign of fracture that is surpassed in value by a careful history and the eliciting of " wincing " tenderness.

I believe that fractures of the radius and ulna or of either alone in childhood are best treated according to the following plan. If reduction be indicated, nitrous oxide gas should be administered for reasons stated above. Attempts at reduction must be repeated until the skiagram shows a satisfactory result. The criterion of reduction of a Colles's fracture or an epiphyseal disjunction is the restoration of the carpal articular surface of the radius to a plane that lies at right angles with the long axis of the forearm. Splints of the proper size are fashioned for the individual case from stout pine board. It is my custom to have at hand for this purpose a stock of boards in lengths and a sharp carpenter's saw. The splints are well padded with non-absorbent cotton, which is retained by a muslin bandage secured by a pin. The padded splint is applied to the forearm and retained, not by plaster, but by a *muslin* bandage. In applying this bandage the first turns are the loosest and the final turns the tightest. The bandage is secured by pins or adhesive strips. The forearm is always bandaged at right angles to the upper arm, lest the upper edge of the bandage cut into the antecubital fossa. A triangular sling is then applied. For fractures of both bones in the upper two-thirds the mid-prone position is liable to result in sagging of the fragments toward the ulnar side, an undesirable circumstance that may be obviated by the position of full supination. The patient reports the next day to insure against ischæmic contracture, and the parent is directed to watch the circulation of the limb by noting the color, temperature, and occurrence of pain, and bring the child around immediately upon the appearance of these disturbances, for it is known that ischæmic contracture may develop within a very few hours. Massage and passive motion are prescribed for the individual case, and the splints removed as soon as firm union is present.

Conclusions.—(1) There is a fracture of the lower third of the

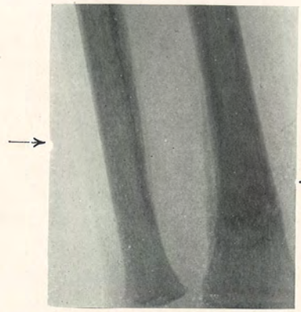

Fig. 14.—The method of diagnosing "first degree" greenstick fractures, patent clinically but obscure in skiagram, by awaiting callus formation. The radial border of the ulna, between the two arrows, shows a strip of callus formation, the lower arrow showing, on close scrutiny, a greenstick fracture. Note callus on radius. Skiagram taken 40 days after injury.

radius and ulna peculiar to childhood and which constitutes about 13 per cent. of fractures of the forearm. This fracture commonly occurs before the age of puberty, is most frequently encountered during the summer months, and is caused usually by the effects of gravity plus momentum. It is characterized by complete fracture of the radius with dorsal and lateral displacement of the lower fragment and by incomplete greenstick fracture of the inner half of the ulna, usually at a higher level, the outer half remaining intact and maintaining the deformity of the ulna, which is a bowing of the lower fragment toward the radial side and which, in turn, maintains the displacement of the distal fragment of the radius. In reducing this fracture the aim must be to convert the incomplete greenstick into a complete fracture by forcibly rupturing the still intact outer fibres, thereby enabling restoration of alignment of the distal fragment of the ulna with that of the axis of the bone, the distal fragment of the radius coincidentally shifting itself automatically into position. The criterion of reduction is the restoration of the normal alignment of the inner border of the ulna.

(2) Fracture of the lower third of both bones and of the radius alone comprise 70 per cent. of fractures of the forearm in childhood. The site of the fracture and its variety may often be predicted by a knowledge of the history and mechanism of the fall.

(3) Injuries to epiphyses, whether strain, sprain, or disjunction, should be recognized and treated as fractures because of their importance in the growth of the bones and because epiphyseal injuries often predetermine infections, typically tuberculous.

(4) Diagnosis may be established clinically by the mechanism and "wincing" tenderness. If deformity exist it is unjustifiable to elicit further signs of fracture. Skiagrams are of corroborative value, but by no means the final arbiters. Their chief value is in showing the degree of deformity and its presence after reduction.

(5) Owing to the delicacy of the radius and ulna in childhood fracture is the rule, while contusion and sprain are the exceptions.

(6) Treatment is begun by the administration of an anæsthetic if deformity exist. Otherwise a carefully prepared and padded splint (or splints) is applied firmly and without undue pressure. Skiagraphic control of reduction is important. Massage and passive motion are adapted to the individual case. The splints must be removed as soon as there is firm union.

(7) Operation is indicated only when conservative treatment is admittedly a failure. It will seldom be necessary. The inlay method of Albee should be used instead of an array of metal fixtures.

TABLE V*

TABLE OF ONE HUNDRED CASES OF FRACTURES OF THE BONES OF THE FOREARM IN CHILDHOOD

Group 1. Fracture of Radius and Ulna in Upper Third: 4 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Greenstick Radius	Greenstick Ulna	Complete Radius	Complete Ulna	Displacement	Remarks
1	36184	..	+	2	From steps	..	+	+	+	..	..	Angulation	Dressed in full supination.
2	39755	+	..	13	Upon forearm	..	+	..	..	+	+	Of radius	
3	41263	+	..	10	Upon extended hand	+	..	+	+	..	..	o	Internal angular splint.
4	35301	+	..	12	From bicycle	..	+	+	+	..	..	Angulation of ulna.	
	4	3	1			1	3	3	3	1	1	3	

Group 2. Fracture of Radius and Ulna in Middle Third: 14 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Greenstick Radius	Greenstick Ulna	Complete Radius	Complete Ulna	Displacement	Remarks
5	39275	+	..	9	Jump from tree-stump	+	..	+	+	..	..	o	Dressed in full supination.
6	35114	+	..	17	While running	+	..	..	..	+	+	Of radius	Dressed in full supination.
7	36264	+	..	11	Downstairs	..	+	..	+	+	..	+ +	
8	36892	+	..	9	From skates	..	+	..	..	+	+	Slight volar angulation.	
9	36078	..	+	9	Upon forearm	..	+	+	+	..	..	Angulation of ulna.	
10	36266	+	..	3	From chair	..	+	+	+	..	..	Slight dorsal angulation	"Buckling," forearm probably doubled under.
11	38342	+	..	9	Slipped, losing balance	..	+	..	..	+	+	o	Fractured twice before.
12	37475	..	+	7	Upon forearm	+	..	+	+	..	..	o	
13	35446	+	..	14	From horse	..	+	..	..	+	+	Slight dorsal angulation	Five weeks old callus present.
14	34613	+	..	15	From bicycle into ditch	+	..	..	..	+	+	Slight ulnar angulation	Treated by gypsum case in Texas.

15	38253	+	..	14	From skates	+	..	..	..	+	+	Slight volar angulation.	
16	38655	+	..	13	From skates	..	+	..	..	+	+	Slight volar angulation	Dressed in full supination.
17	37746	..	+	11	?	+	..	+	..	..	+	Ulna encroached on interosseous space.	
18	35405	+	..	3	?	..	+	..	+	+	..	Slight lateral angulation	Ulna incomplete internally.
	14	11	3			6	8	5	6	9	8	11	

Group 3. Fracture of Radius and Ulna in Lower Third: 32 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Greenstick Radius	Greenstick Ulna	Complete Radius	Complete Ulna	Displacement	Remarks
19	38092	+	..	15	From bicycle	+	..	..	+	+	..	Lateral	"Special."
20	38002	+	..	9	From railing	..	+	+	+	..	..	o	
21	40734	+	..	14	From bicycle	+	..	..	+	+	..	Dorsal and lateral	"Special."
22	40288	+	..	9	While running	+	..	..	..	+	+	Slight volar angulation.	
23	38669	+	..	6	?	+	..	..	+	+	..	Dorsal and lateral	"Special."
24	40201	+	..	14	From skates	+	..	+	+	+	..	Dorsal and lateral	"Special."
25	40312	+	..	11	Upon hyperextended hand	+	..	..	+	..	..	Volar angulation.	
26	41221	+	..	13	Down 3 steps	+	..	+	+	+	..	Dorsal and lateral	"Special."
27	38742	+	..	6	While running	+	..	..	+	+	..	Volar angulation.	
28	33837	+	..	13	On hyperflexed hand	+	..	..	+	..	+	Volar angulation.	
29	35873	+	..	11	From tree, four feet	+	..	+	+	..	..	Volar angulation.	
30	37376	+	..	16	Landing from pole-vault	..	+	..	..	+	+	Volar angulation.	
31	37991	+	..	9	From haystack	..	+	..	+	+	+	Lateral and dorsal.	
32	36883	+	..	12	Struck dorsum of wrist on ground?	+	..	+	..	..	..	o	"Buckling" of radius.
33	41564	+	..	7	From swing	+	..	..	+	..	..	Dorsal	"Special."
34	41033	..	+	4	From porch-rail	+	..	..	+	+	..	o	"Special."
35	39890	..	+	13	While sledding	..	+	+	+	..	..	Volar angulation.	
36	41004	+	..	12	Fighting	..	+	..	+	+	..	Dorsal	"Special."
37	35166	+	..	16	Against curb	+	..	..	..	+	+	o	
38	41262	+	..	10	Upon hyperflexed hand	..	+	..	..	+	+	Dorsal	"Special."
39	35224	+	..	12	From ladder, 10 feet	+	..	..	+	+	..	o	"Buckling" from hyperflexion.
40	41488	+	..	14	Backward on hyperextended hand	+	..	..	+	+	..	Dorsal and lateral	"Special."
41	34125	+	..	14	From skates	..	+	+	+	..	..	Dorsal of ulna	"Buckling" of radius.
42	37129	..	+	8	Upon hyperextended hand	+	..	..	..	+	+	Dorsal.	
43	35066	+	..	11	From tree	+	..	+	+	..	..	Volar of radius.	
												Dorsal	Impaction of radius.

* The incomplete histories in these groups represent those cases not observed by the writer.

TABLE V.—*Continued*

Group 3.—*Continued*

Case	No. of Case Record	Sex		Age	Nature of Fall	Right	Left	Greenstick		Complete		Displacement	Remarks
		M	F					Radius	Ulna	Radius	Ulna		
44	34925	+	..	8	Upon hyperextended hand	..	+	+	+	..	..	Dorsal of radius	"Special."
45	35168	..	+	17	Downstairs	..	+	..	..	+	+	Dorsal.	
46	35101	+	..	12	From high jump, 3 feet	..	+	..	..	+	+	Dorsal.	
47	38266	+	..	7	While running	..	+	..	+	+	..	Dorsal of radius	"Special."
48	36681	..	+	12	From skates	..	+	..	..	+	+	Dorsal	"Special."
49	37668	+	..	11	From cherry tree	..	+	..	..	+	+	Dorsal and mesial.	
50	37822	+	..	9	From tree, 7 feet	..	+	+	+	..	..	Dorsal of radius.	
	32	27	5			18	14	10	22	22	10	27	

Group 4. Fracture of Radius (Lower Third) and Ulna (Styloid Process): 6 Cases. Velpeau Fracture

Case	No. of Case Record	Sex		Age	Nature of Fall	Right	Left	Greenstick	Complete	Displacement	Remarks
		M	F								
51	34297	+	..	12	From skates	..	+	..	+	0	Abrasion of hand.
52	PH 1756	..	+	10	From swing	+	..	+	..	Dorsal.	
53	34768	+	..	14	From porch	..	+	..	+	"Silver-fork."	
54	41416	..	+	12	Downstairs upon hyperflexed hand	..	+	+	..	"Buckling" dorsally	Note buckling from hyperflexion.
55	37285	+	..	11	?	..	+	..	+	Dorsal.	
56	38555	..	+	9	?	+	..	+	..	"Buckling" dorsally	Cause probably hyperflexion.
	6	3	3			2	4	3	3	5	

Group 5. Fracture of Radius in Upper Third: 3 Cases

Case	No. of Case Record	Sex		Age	Nature of Fall	Site	Right	Left	Impacted	Complete	Remarks
		M	F								
57	41242	..	+	6	Down 5 steps	Neck of Radius	..	+	+	..	Occasional epiphysis for upper third olecranon present.
58	39320	+	..	14	Upon forearm	Neck of radius	+	..	+	..	Head of radius slightly luxated anteriorly.
59	40520	..	+	11	?	Shaft	+	..	..	..	History incomplete.
	3	1	2				2	1	2		

Group 6. Fracture of Radius in Middle Third: 3 Cases

Case	No. of Case Record	Sex		Age	Nature of Fall	Direct Violence		Greenstick	Complete	Remarks
		M	F			Right	Left			
60	38682	+	..	15	From motor	+	+	..	+	Oblique, with loose fragment on side of concavity.
61	35802	+	..	4	From cycle	+	+	+	..	Incomplete mesially.
62	41164	+	..	12	Boy trod on	+	+	+		
	3	3				3	3	2	1	

TABLE V.—*Continued*

Group 7. Fracture of Radius in Lower Third: 16 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Greenstick	Complete	Colles's Fracture	Displacement	Remarks
63	35872	+	..	6	Upon hyperextended hand	..	+	..	+	..	0	
64	35015	+	..	5	From cherry tree	..	+	+	..	..	0	
65	34612	..	+	10	?	..	+	+	..	..	Dorsal angulation.	
66	35075	+	..	13	From slipping; upon hyperextended hand	..	+	+	..	..	Volar angulation.	
67	PH 1640	+	..	14	From cherry tree	+	..	..	+	..	Dorsal.	
68	PH 1589	+	..	10	From bed	..	+	+	..	..	0	"Buckling."
69	37959	+	..	11	From fence, striking dorsum on stone	+	..	..	+	..	Dorsal	Impacted.
70	37030	+	..	13	From skates	+	..	+	..	..	Dorsal angulation.	
71	38557	+	..	12	A boy forcibly hyperextended hand	..	+	+	..	..	Dorsal angulation.	"Buckling."
72	41117	+	..	9	Upon hyperflexed hand	..	+	+	..	..	0	"Buckling" from hyperflexion.
73	37948	+	..	17	Upon hyperflexed hand	+	..	..	+	..	Reverse volar	Reverse of Colles's from hyperflexion.
74	36864	+	..	14	?	..	+	+	..	+	Dorsal angulation.	
75	35967	+	..	11	From skates upon hyperextended hand	..	+	+	..	+	Dorsal angulation.	
76	34413	+	..	17	From skates	+	..	..	+	+	Dorsal.	
77	38642	+	..	15	Upon hyperextended hand	..	+	+	..	..	0	"Buckling."
78	41457	..	+	6	From chair	..	+	+	..	+	Dorsal angulation.	
	16	14	2			5	11	11	5	4	11	

Group 8. Strain, Sprain, and Disjunction of Epiphysis at Lower End of Radius

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Juxta-epiphyseal Strain	Juxta-epiphyseal Sprain	Dorsal Displacement	Separation Tip of Ulnar Styloid	Remarks
79	41246	..	+	13	From skates on hyperextended hand	..	+	..	..	+		
80	37996	+	..	9	?	+	..	..	..	+		
81	38115	+	..	14	Upon hyperextended hand	+	..	..	..	+	..	One month old; treated elsewhere for contusion.
82	38604	+	..	14	?	?	?	..	..	+	..	History incomplete.
83	40542	+	..	16	While running, upon hyperextended hand	..	+	..	..	+	..	Annular tenderness.
84	41146	+	..	11	Upon hyperextended hand	+	..	..	..	+	..	One year old; treated elsewhere for sprain; function impaired.
85	40724	+	..	12	?	+	..	..	..	?	..	History incomplete.
86	40171	+	..	10	?	?	?	..	..	?	..	History incomplete.
87	39687	+	..	14	From skates	..	+	..	..	?	..	History incomplete.
88	35194	+	..	13	From pole, 15 feet	+	..	..	..	?	..	Also, chip separated from radial border of metaphysis.
89	36125	+	..	10	From trapeze	..	+	..	..	?	..	Treated elsewhere as sprain. Annular tenderness.
90	35983	+	..	13	Down steps upon hyperflexed hand	+	..	..	..	+	+	
91	41521	+	..	12	From cherry tree upon hyperextended hand	..	+	..	..	?	+	
92	41103	+	..	19	Upon hyperextended hand	+	..	..	+	?	..	Annular tenderness.
93	40657	+	..	13	Upon hyperextended hand	+	..	..	..	0	+	Also, chip separated from radial border of metaphysis.
94	41122	+	..	9	From cherry tree, 15 feet	..	+	+	..	0		
	16	15	1			8	6	1	1	7	3	

TABLE V.—*Continued*

Group 9. Fracture of Ulna in Upper Third: 2 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Site	Greenstick	Complete	Remarks
95	34140	+	:	11	Upon hyperextended hand.....	+	:	Just below greater sigmoid cavity ..	+	:	Line runs from above and behind downward and forward.
96	40876	+	:	12	Playmate fell on forearm.....	+	:	Shaft.....	:	+	
	2	2	0			2	0		1	1	

Group 10. Fracture of Ulna in Middle Third: 4 Cases

Case	No. of Case Record	Sex M	Sex F	Age	Nature of Fall	Right	Left	Displacement	Greenstick	Complete	Remarks
97	35000	:	+	4	From couch.....	:	+	0	+	:	16 days old; brought because of persistence of pain.
98	35153	:	+	7	From swing.....	:	++	++	: :	++	Diagnosed contusion elsewhere.
99	34654	+	:	14	Struck against log.....	:	:	+	:	+	Direct violence preponderates in fractures of ulna. No luxation of head of radius in this series.
100	37920	+	:	9	From tree.....	+	:				
	4	2	2			1	3	3	1	3	

STATED MEETING, NOVEMBER 2, 1914.

The President, Dr. John H. Gibbon, in the Chair.

SARCOMA OF THE TONSIL TREATED WITH RADIUM

Dr. Nathaniel Ginsburg presented a man, forty-nine years of age, who was brought before the Academy of Surgery a month ago with a tumor of the right side of the pharynx. The condition had been diagnosed as an inoperable malignant tumor of the right tonsil. The case was apparently hopeless from the stand-point of further surgery and the patient was sent to Dr. Newcomet for the use of radium. The entire right side of the throat was filled by a mass which has now entirely disappeared.

Dr. John B. Roberts said that he wished Dr. Ginsburg could tell what the clinical characteristics of really malignant tumors of the tonsil are. There is difficulty in recognizing them with certainty. Three or four years ago a man in his ward at the Methodist Hospital said to him, "You don't recognize me, do you, Doctor? I am the man from whose throat you took the cancer of the tonsil." He then recollected that about ten years before he had operated upon him for malignant disease of the left tonsil. He supposed he was dead long ago. He had sawed his jaw apart, after chloroforming him by means of a tube passed through a tracheal incision, and took out the tonsillar growth and also a portion of the soft palate. No radium was applied and no X-ray. It was before we were familiar with radium and probably before the X-ray was used to any extent. Yet here was a man who lived something like ten years with no return of what was pronounced, by the pathologist making the microscopical examination, a malignant tumor. The man was sent to Dr. Walter Roberts, who could find nothing wrong, except a cicatricial condition where about ten years before there had been this mass. There is something peculiar about these tonsillar growths which is not understood and which the pathologists do not recognize as to the histological structure. Some years previously Dr. Roberts saw a tonsillar growth, which had been diagnosticated by a renowned laryngologist as a malignant tumor. The family physician and the speaker believed it to be syphilitic. This, active treatment proved to be the true diagnosis.

DRAINAGE AFTER NEPHROSTOMY

Dr. B. A. Thomas presented a patient who had had two nephrostomies. One side was operated upon in last January; the other in February. The Watson apparatus did not work satisfactorily in this case. After taking the course of the fistula, he then devised two sterling silver drains to which tubes were attached to convey the urine around in front to a receptacle. The photographs (Figs. 1, 2 and 3) show the patient before and after the use of the Watson apparatus and also with the silver drains inserted. Inside the silver drains have bulbous extensions which prevent their displacement, also external flanges which prevent them from going in too far. It has been almost a year since the operations were done. The man has multiple recurrent polypi of the bladder and has been coming to the dispensary every other day for several months for dressings. In taking the drains out last week for washing and removal of contained phosphatic deposits considerable pain was caused. The man has gained ten pounds in weight since the operation, is in much better condition than before his nephrostomies, and insists upon his third promised operation—a cystectomy, which will be performed in a few days.

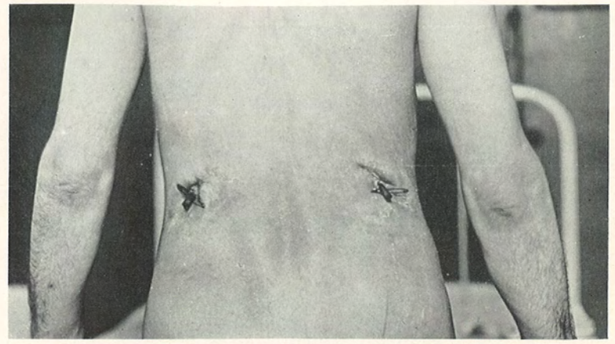

Fig. 1.—Bilateral nephrostomy, drains emerging in each lumbar region.

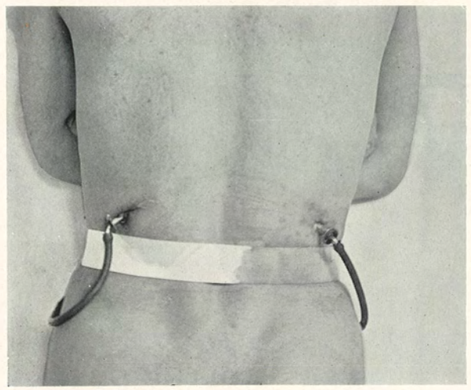

Fig. 2.—Tubes attached to carry urine to receptacle in front.

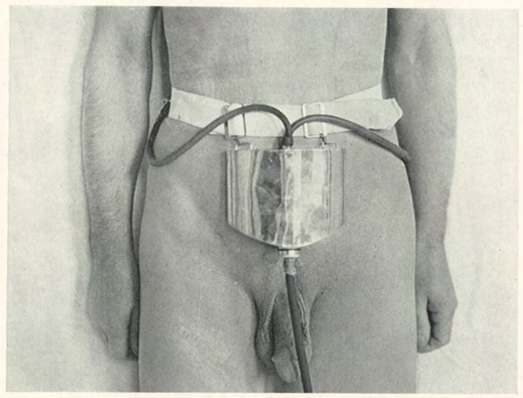

FIG. 3.—Nephrostomy. Urinary receptacle in front above pubis receiving tubes coming from drains emerging behind.

THE SURGICAL ANATOMY OF THE UPPER AND LOWER POLES OF THE THYROID GLAND WITH REFERENCE TO THYROIDECTOMY

By NATHANIEL GINSBURG, M.D.
OF PHILADELPHIA

OPERATIVE procedures upon the thyroid gland are rendered difficult or simple in execution largely by the anatomical factors determining the disposition of the blood-vessels related to the upper and lower poles of this body. Accessibility of these vessels is not always easy, owing to the distortion of the gland mass by overgrowth, with consequent upward and downward extension, and displacement of the usual landmarks commonly noted to definitely localize the vessels entering the gland substance.

Severe hemorrhage not infrequently attends partial removal of the thyroid gland owing to retraction of the vessels (usually veins) after incision, or as the result of failure of a ligature to include all the vessels. The troublesome bleeding during the course of this operation is usually ascribable to the veins whose number and size are far greater than the standard text-book descriptions lead one to believe.

Close studies in the anatomical laboratory of the University of Pennsylvania over a number of years, with careful inspections of many hundreds of thyroid glands, dissected in normal position, has impressed the writer with the frequency of the anomalous distribution of the thyroid vessels, particularly the veins (Fig. 1). Clinical evidence to corroborate these views has also been found by the writer in operations upon the thyroid body in the living.

Isolation of the superior thyroid artery is always a simple matter because this vessel is invariably directly related to the upper apex of the lateral lobe, dividing, however, before it penetrates the substance of the gland. The distribution of the blood stream is over the ventral gland surface, a dorsal branch of some size, however, continuing down the dorsomesial surface of the lobe to form an anastomotic channel completed by an ascending branch of the inferior thyroid artery. It is from this anastomotic channel that the parathyroid glands hang and therefore derive their blood supply. Since the division of the superior thyroid into the two main stems often takes place at a distance of from two to three centimetres from the gland, the importance of grasping

both vessels in a circumscribing ligature having for its purpose complete pole ligation is significant. It is not by any means difficult to miss the dorsal stem of this artery in passing the ligature, and hence the explanation of a failure to realize an expected improvement in a patient with a toxic goitre after complete single or bilateral ligation of the superior thyroids was thought to have been accomplished.

The superior thyroid vein is usually a single vessel, but, as shown in the illustration, possesses an anatomical relationship to the internal jugular vein, which may give rise to severe hemorrhage after apparent ligation of the superior thyroid vessels has been practised. This short, thick venous trunk, passing transversely into the wall of the internal jugular vein, demands careful ligation, and this is safer than the application of a forceps. The writer was compelled during the past year to ligate the internal jugular vein in two patients, following the retraction of this vein which simulated a punctured wound of the vessel wall. This unusual procedure did not, however, in either instance, complicate the injury or offer any untoward cerebral effects.

The middle thyroid vein is fairly constant, short in length, and likely to be overlooked in lobectomy; especially since traction of the gland mass toward the median line often reduces this vessel to a collapsed thin cord which bleeds freely, if incised, when release of traction takes place.

Occasionally the inferior thyroid artery is wanting on one side, and a huge superior thyroid artery compensates for its absence. Obviously, this anatomical state would be ideal for polar ligation as a surgical procedure, and would rob the whole lobe of a large part of its blood supply. No example of an absent superior thyroid artery has been noted, although this vessel has been seen to arise from the common carotid artery. (This observation was made in the Anatomical Laboratory.)

The inferior thyroid artery is considerably larger than the superior thyroid, and has a more direct origin from the parent vessel (subclavian). Owing to its greater size and glandular distribution, it delivers a greater blood supply to the thyroid gland than its fellow of the same side. It passes vertically upward and thence medianward behind the carotid sheath, and always divides into a number of large glandular branches before entering the gland tissue. The division is opposite the centre of the gland lobe, and this vessel is mistakenly thought by some to have a relationship to the lower pole of the lobe similar to the arrangement which the superior artery bears to the upper pole. The inferior laryngeal nerve (motor to the larynx) is intimately related to the main glandular branches as they pass across the lateral

tracheo-œsophageal sulcus, passing between two or more branches or lying dorsal to all of them.

Ligation of the inferior thyroid artery before division requires retraction of the carotid sheath either lateralward (Halsted), or medianward (Rogers), extending the dissection beyond the confines of the gland capsule, and cannot be easily accomplished through a small incision. Ligation of the main branches before they enter the gland is attended with danger, since the motor laryngeal nerve may be included in the ligature. The peripheral ligation of the vessels in the gland substance, with retraction of the lobe toward the median line, spares both the nerve and the parathyroids and has been the procedure adopted since advised by Kocher, Halsted and Mayo. This method does not ligate the inferior thyroid *en masse,* but makes possible the plastic resection of the lower pole, and is the theory upon which Mikulicz based his suggestion of plastic gland resection, which has been recently mentioned in an excellent paper by Balfour of Rochester, Minnesota.

Rogers of New York advocates quadruple ligation of the thyroid vessels, with nerves included in the ligatures, and reports thirty-six cases of typical exophthalmic goitre operated upon prior to January 1, 1913, by this method. He approaches the lower arteries through a vertical incision over the lower end of the posterior border of the sternomastoid muscle. "The approach exposes and passes in front of the phrenic nerve on the scalenus anticus muscle. The inferior thyroid can then be felt and reached behind the internal jugular vein and common carotid artery."

The conception of this procedure is fundamentally based upon a certainty of accomplishing a reduction of the glandular arterial burden, and no other operation upon the thyroid save total excision will equal it in this respect. The results reported by Rogers upon the thirty-seven cases offers incontestable proof of the value of his procedure. This writer also attempts to explain failure in two of his earlier cases, following quadruple ligation of the thyroid vessels and nerves, in which improvement became stationary, upon the operative findings at the second operation. He states, "exploration revealed a reformation of one or more collateral branches at the primary operation. It is technically difficult to be sure of securing all the twigs given off from the superior thyroid, especially in a nervous subject under local anæsthesia."

It is evident from these latter statements, that at the primary operations upon these two patients, Rogers may have missed in the superior pole ligatures the dorsal branches to the gland to which attention has

been previously directed. It must not be forgotten that in toxic goitres, of the exophthalmic or non-exophthalmic type, either single or multiple ligation at best only affects the conduction to and from the gland of both blood and gland elements, leaving the increased secretory surfaces still intact, since Wilson and Plummer have proven beyond all doubt that hyperplasia of the thyroid is complementary to hyperthyroidism.

The very free anastomoses of the arterial system, and the great numerical constancy of the veins leaving the thyroid gland, should make one pause and wonder that a single or double polar ligature can very materially reduce the blood supply to this organ. The clinical evidence is incontrovertible in a large percentage of cases (Kocher, Mayo and others), but there are patients in whom no evidence of improvement is noted, following this attempt to diminish the thyrotoxicosis, by reducing the blood supply to the gland and the coincidental delivery of the secretion into the blood system. It is likely that failure in these cases is dependent upon the anatomical factor involving the vessels entering and leaving the gland. Dr. Halsted resorts to ligation of the inferior thyroid in preference to the superior vessels. His technic undoubtedly makes possible successful occlusion of the inferior thyroid artery, since the vessel is secured behind the carotid sheath before division into terminal branches takes place. His ligature, however, does not circumscribe the veins related to the lower pole of the lobe and in this respect the operation only accomplishes one-half of the same procedure applied to the superior vessels. The value of ligation attaches as much to venous occlusion as to arterial interruption, and an examination of the large veins, related to the lobes and isthmus below, will at once prove the truth of this observation. Halsted states that in his clinic preliminary ligation is always practised as the first stage of surgical treatment in cases of toxic goitre to improve the patient's condition and to test the resistance to operation. He further states, "that in no instance have we found that the preliminary ligation of two, three, or even of the four arteries, sufficed to cure the patient seriously ill with Graves' disease, although we have observed that considerable improvement, for a short time at least, may follow the ligation of even a single artery."

The writer performed a double superior pole ligation upon a patient *in extremis* (Figs. 2 and 3), and following a stormy post-operative period, improvement was so marked that further surgical interference was refused and finally became unnecessary. In another case (Figs. 4 and 5), in which long continued medical treatment reduced the patient to almost complete disruption, double ligation of the superior vessels

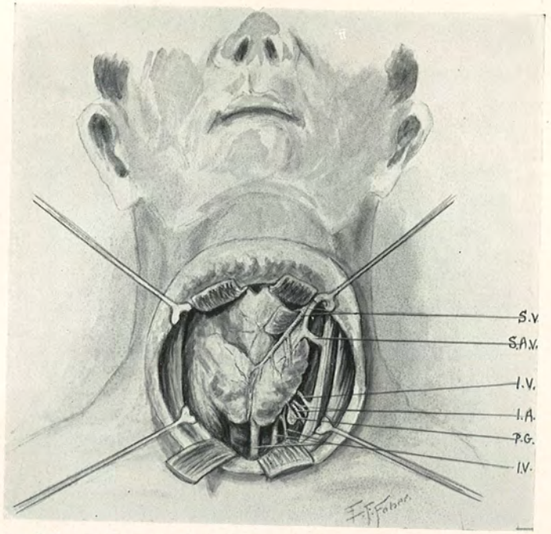

FIG. 1.—*S. V.*, superior vessels; *S. A. V.*, superior accessory vein; *I. V.*, inferior thyroid veins; *I. A.*, inferior thyroid arteries; *P. G.*, parathyroid gland. Note the venous arrangement at the superior pole of the gland, the short vein passing outward at right angles to the gland to enter the internal jugular vein. The inferior vessels are numerous and the veins are very large. Note the large inferior median vein descending along the trachea. Ligation of the inferior thyroid artery before it breaks up into its branches does not affect the venous return from the gland.

FIG. 2.—L. K., aged fifty years. Toxic exophthalmus. Duration of goitre eight years. Weight at operation eighty pounds. Emaciation marked. Bilateral ligation of superior poles of thyroid. Recovery so marked that further operative treatment was unnecessary.

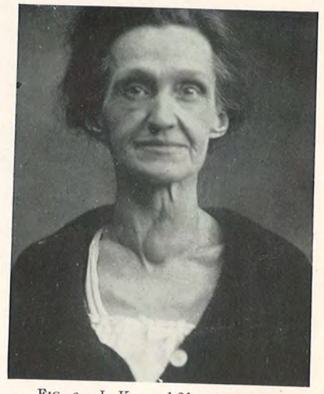

FIG. 3.—L. K., aged fifty years. Same as Fig. 2. Note large left lobe and isthmus.

FIG. 4.—E. M., single, aged twenty-seven years. Intensely toxic goitre. Bed-ridden for three months. Bilateral superior pole ligation had no effect. Secondary right lobectomy with marked improvement.

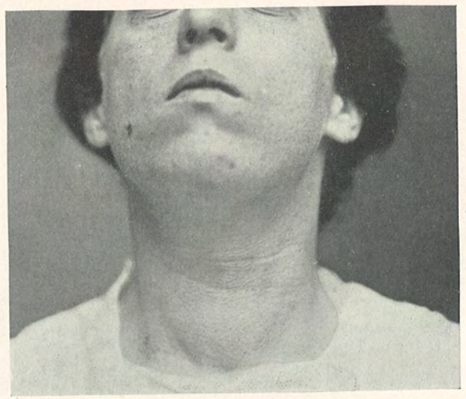

FIG. 5.—E. M. Note small size of goitre and moderate exophthalmus. Duration of symptoms sixteen months.

utterly failed to change the clinical picture. Seven weeks after this operation unilateral lobectomy was performed, and the reason for the failure of the first operation became clear. The blood supply, interrupted by closure of the superior vessels, was more than offset by the abundance of blood entering and leaving the gland by numerous and large inferior thyroid vessels. Examination revealed a completely ligated superior pole on both sides, since the linen ligature was examined, and had circumscribed all the vessels entering this portion of the gland.

In spite of the fact that enucleation should be subcapsular and all manipulations carried on close to the gland, troublesome hemorrhage will often arise, and the purpose of this communication is to direct attention to some anatomical factors the knowledge of which will render excision of a part of this organ easy or difficult. Operations upon the thyroid now constitute one of the safest of all surgical procedures, and if toxic cases are treated early surgically, before prolonged medical treatment exhausts the patient, this operation will be placed in the category of results of operations for acute appendicitis when done within the first twenty-four hours.

DR. A. P. C. ASHHURST said that several years ago as a result of elaborate experiments Delore and Alamartine pointed out that the circulation of the thyroid is much freer between the upper and lower poles of each lobe than across the midline. On this account they advised ligation of the superior and inferior arteries on the same side instead of both superiors, as had been done usually before. They also urged ligation of the inferior artery near its origin, exposing it by incision on the outer side of the sternocleidomastoid muscle. Dr. Halsted recently also has come to the conclusion that the inferior artery is best ligated, not close to the gland, but somewhere nearer its origin.

THE PREVENTION OF POST-OPERATIVE ADHESIONS IN THE PERITONEAL CAVITY

By Joshua Edwin Sweet, M.D., R. H. Chaney, M.D.
and
H. L. Willson, M.D.
of Philadelphia
(From the Laboratory of Surgical Research, University of Pennsylvania)

The problem of checking or limiting intestinal adhesions following abdominal section is of such great practical importance that it has stimulated many suggestions for solution. It was considered advisable to undertake an experimental comparative test of some of these methods which have been advocated. The work was carried out upon dogs which were at the time of operation under complete surgical anæsthesia with ether, and which received both before and after operation the best possible care. In all operative work the strictest methods of asepsis were employed, such as are used in the operating rooms of modern hospitals.

The first work, done in a measure for a control series, was simple intestinal anastomosis. In these cases the abdomen was opened by midline incision about three inches in length, extending upward from the umbilicus. The gut was drawn out through the wound, protected by gauze pads, a section removed, and an end-to-end anastomosis performed. The gut was then returned to the abdominal cavity and the wound closed by the layer method. In all the following work the same type of incision was used, and the same method of closing the wound.

Two cases of simple end-to-end anastomoses were done. These animals were killed by gas at the end of six and eight weeks respectively. In both cases the abdomen was free from adhesions, the gut normal and no signs of peritonitis were present.

The next experiment in the series was performed to see what the effect of covering the operative area with an attached portion of omentum would be. In these instances two end-to-end anastomoses were performed on the same intestine, the first being left free without covering; the second being covered with the free border of the omentum. The omentum was carefully wrapped over the site of operation and held in position by a couple of silk stitches. This dog was killed and autopsied three weeks after the operation. The abdominal cavity was

free from exudate or any indication of peritonitis, and free of adhesions, save for the point at which the omentum had been attached to the site of anastomosis at the time of operation.

The next two dogs operated upon were treated in a similar manner with the intention of observing the effect of free omental and mesenteric grafts in the prevention of adhesions. In all of these cases three anastomoses were made—one left free without covering; one covered with a free piece of omentum, while the last was covered with a free piece of mesentery.

The strip of omentum was taken from the lower free border—the raw surface of the omentum being closed with a fine silk ligature. The strip of mesentery was taken from the redundant mesentery left after the removal of a section of the bowel. The grafts were held in place over the points of anastomosis by a few fine silk sutures.

In the first dog—autopsied two weeks after operation—the free uncovered anastomosis was the site of a few but rather dense adhesions, while both of the covered areas—the one being covered by omentum and the other by mesentery—were absolutely free from adhesions. There was no sign of peritonitis, adhesions about the free area being simply due to the attachment of the omentum to that area.

In the second dog, autopsied one week following operation, there was no trace of adhesions or peritonitis. In each case there was no free fluid in the abdominal cavity.

Following these experiments studies were undertaken concerning the effect of liquid paraffin in checking adhesions. In these cases some ten minutes before opening the abdomen, 100 c.c. of sterile paraffin oil was injected into the abdominal cavity by means of a large syringe and needle. This apparently large amount of oil was used because of the fact that during the operation a considerable amount of the oil would overflow through the wound.

The reason for the injection of the oil into the abdomen previous to operation was that the entire peritoneal surface would become thoroughly coated with a film of oil before being exposed to the air. All sponging at the time of operation was done with gauze saturated with the sterile oil. Four dogs were employed in this series, the operation in each case consisting of two end-to-end anastomoses. In each case, as will be noted later, there was an extensive exudation of leucocytes into the abdominal cavity. Because this exudation was so great, it was examined under the microscope and the granularity of the cells and their apparent fragmentation led us to believe that their functional

power as phagocytic agents might be diminished. The following method was adopted in the last two cases of this series, and in some of the cases of the following series, to test this phagocytic activity. Immediately after the abdomen was opened at autopsy about 25 c.c. of the exudate there found was collected in a sterile flask. This was then mixed with an equal amount of sterile, warm saline solution and centrifuged. This resulted in the throwing down of a considerable portion of the leucocytic cells which were again collected and rewashed until the leucocytic cream was freed from oil and of a uniform consistency. In these cases the animal was killed by ether and just before death the carotid artery was opened and 50 c.c. to 75 c.c. of blood obtained. This was defibrinated and centrifuged; a portion of the serum was decanted and placed in an incubator until the washing of the cells was complete.

The leucocytes from the blood were then washed simultaneously with those from the abdominal exudate, both samples of leucocytes being thus treated in the same manner so that there should be no difference in their activity because of variation in the mechanical manipulation. These two samples of leucocytes—one obtained from the exudate in the peritoneal cavity, the other from the blood of the same animal—were mixed with the blood serum from the same animal and a bouillon suspension of *Micrococcus aureus* in the proportions commonly used in obtaining the opsonic index for the blood serum, and incubated for half an hour. The leucocytes were the unknown factor in these cases and not the serum. The ratio of the number of bacteria taken up by the leucocytes from the abdominal exudate to the number of bacteria taken up by the leucocytes from the blood of the same animal is what we shall here call the phagocytic index of the given case.

The first animal died from a diffuse peritonitis nine days after operation. Autopsy showed no marked adhesions, though many fine fibrinous strands were adherent to the gut; the abdomen contained 125 c.c. of thick, oily and whitish exudate. The second animal was killed and autopsied ten days after operation. A local peritonitis was present about the operated areas with extensive adhesions matting the intestinal loops together, although these adhesions did not directly involve the operated areas; 200 c.c. of fluid was found in the belly, of the same character as that found in the previous case.

The third dog was autopsied seven days after operation, a general low grade peritonitis accompanied by fine plastic adhesions throughout the abdomen being found; 150 c.c. of the same characteristic exudate was present. The phagocytic index in this case was 3:14. The fourth dog was autopsied four days after operation and an extensive exudation with large amounts of sticky, fibrinous material generally spread over the gut but unorganized was found; 200 c.c. of exudate was present. The phagocytic index in this case was 4:15.

In considering the results in the foregoing experiments the question naturally arises as to whether the adhesions so constantly present were due to the presence of the oil or to some fault in technic. It was decided to inject the same amount of oil directly into the abdominal cavity and observe the result. In a series of three dogs 100 c.c. of sterile paraffin oil was injected directly into the abdomen by means of a large needle and syringe—the animals then being killed at intervals. The first dog, autopsied four days after injection of oil, showed exudate amounting to 200 c.c. with fine plastic adhesions throughout the abdominal cavity; the phagocytic index was 4:16. The second dog was autopsied eight days after the injection of oil, showed 125 c.c. of exudate and many plastic adhesions binding the gut generally in a mass; the phagocytic index was 3:17.

From the third dog, autopsied twelve days after injection, 160 c.c. of exudate was recovered and dense adhesions were found binding the gut into so firm a mass that it was impossible to separate the adhesions without tearing the serous surface; the phagocytic index was 0:16.

Because of the unsatisfactory results in our experiments thus far, it was decided to try in one case the injection of sterile olive oil. This was done in the same manner as before, the dog being autopsied eight days after the injection. Generalized adhesions throughout the abdomen were found, the exudate being extensive in amount. No attempt was made to determine the phagocytic index and nothing further was done with this substance.

At this time a question arose as to the purity of the paraffin oil used and, at the suggestion of Dr. Taylor, we determined to try the result of using glymol, a proprietary preparation, which he had found to be of a high grade of purity. This was used experimentally in three cases. In the first dog, the sterile oil was injected directly into the abdomen, no operative measures being employed. The animal was killed and autopsied three days later. The results were other than we had expected from our former work with paraffin oil. In this case only 80 c.c. of the oil had been injected because of the small size of the dog. At the autopsy only 60 c.c. of exudate was found in the abdominal cavity, the exudate presenting a clear, homogeneous appearance.

The leucocytes under the microscope appeared normal and the phagocytic index was 8:10. The gut was normal in appearance and no trace of adhesions was present. Because of this apparent good

result, the operative measures used in the earlier cases were again resorted to. In the second series, 110 c.c. of sterile glymol was injected into the abdominal cavity before making incision. The gut was carefully protected and all sponging done with gauze saturated with the oil. Two end-to-end anastomoses, as in the former instances, were performed. The animal died thirteen days later from peritonitis; 250 c.c. of exudate was found in the cavity. Marked plastic adhesions binding the entire gut together were present, also a localized abscess at the lower point of anastomosis. Cultures from the fluid in the general abdominal cavity were sterile. The peritoneum was generally opaque. The last dog of this series was handled in the same way, save that only 90 c.c. of glymol was injected previous to operation. At autopsy, four weeks later, adhesions to the abdominal wound and around the operative site were found. A general fibrinous peritonitis of low grade was also apparent and small fat or oil droplets could be seen in the broad ligaments and omental lymph spaces. The exudate was 25 c.c. in amount and of the same character as found in cases where paraffin oil had been used. The few leucocytic cells present showed marked granular change and the phagocytic index was 0: 12.

While still working on the use of oils, it occurred to us, as we were bleeding a dog into citrate solution, that if citrate prevented the normal ferment action in blood whereby fibrinogen was changed to fibrin, the same might hold true if the solution were placed in the abdomen after operation, thus limiting the formation of adhesions. This would, however, seem to be an attempt to limit a function which is normally necessary in the repair of serous surfaces. Adami distinctly states in dealing with the process of healing of serous inflammation that the first step in the process is the outpouring of an uncertain amount of plastic lymph which tends to glue the surfaces together, later to become organized and remain as scar tissue. Thus, if the formation of this plastic lymph were prevented would not the liability of infection passing from intestinal tract to peritoneum be increased, especially in cases where the gut had been opened? Our attention to this mode of dealing with adhesions was further stimulated by the results which Pope published in the ANNALS OF SURGERY, reporting the use of citrate solutions in checking adhesions in rabbits in cases where the peritoneum was simply scarified, though the gut was not opened.

To gain some personal evidence, citrate solutions were employed in seven cases in the following manner. As before, end-to-end anastomoses were performed in two sites with the same aseptic care as before, but

just before closing the abdomen 50 c.c. of a 3 per cent. sodium citrate solution in normal salt solution was emptied into the cavity.

The major thing noted at the time of operation was that, even with this small amount, it was extremely hard to keep the solution from running slightly over the edges of the abdominal wound. This caused a very marked oozing in each case, making the closure of the wound more than normally difficult.

The first dog of the series, autopsied two weeks after operation, showed imperfect healing of the abdominal wound, a gap into the deep tissues at least three-eighths of an inch being present at one end. Inside there were extensive adhesions of the omentum to the gut about the operative areas and some adhesions were present between the adjacent loops of intestine. Only a very small amount of fluid was present, a culture from which gave what appeared to be pure colon bacillus growth. In the second dog of the series, autopsied a week after operation, while the peritoneal edges of the wound were healed, the skin and fascial layers were imperfectly healed. Within the abdomen adhesions were present both of the omentum to the gut and of the adjacent loops of gut. In the third member of the series the abdominal wound split open on the third day after operation and the dog had to be killed. The fourth dog died from general peritonitis four days after operation, two local abscesses being present near the operative points. The fifth, sixth and seventh members of the series, autopsied fourteen, nine and seven days after operation respectively, presented similar pictures. General adhesions were present of the omentum to the gut in the neighborhood of the operative areas, and adhesions were present between the adjacent loops of intestine to a considerable extent. In none of these cases was distention noted nor was fluid found within the cavity. In no instance was there perfect healing of the abdominal wound, a distinct contrast with the former cases.

In discussing the above results we note that in five cases where no other means than simple careful technic and covering of the operative area with omentum or mesenteric strips were used, adhesions resulted in only one case, this being one where adhesions were found to the uncovered area, the covered areas in the same case being free. In eleven cases where some type of oil was used in the endeavor to limit adhesions, these were formed in nine cases. In one of the cases where adhesions were absent peritonitis caused the death of the animal, only a single case being free from adhesions or peritonitis. In all of the eleven cases more or less extensive exudation was present. In seven out of the eleven cases in which oil was used the phagocytic index was

tested, and in all save the first experiment with glymol the index was markedly reduced, and even in this case it was not normal. This is shown more markedly by the accompanying chart, a study of which shows that in no case was the index higher than 8: 10, once as low as 0: 16, while the average index was about 4: 17. From this work it can be deduced that oil in any form causes an intense exudation of leucocytes into the abdomen and these are inhibited from their normal physiological function by the presence of the oil, as indicated by the low phagocytic index. Thus it can be stated that oil is contra-indicated, if for no other reason than that anything which causes local migration of these cells and then checks their action simply increases the bulk of foreign material with which the tissues have to deal.

Substance Injected	Amount Injected	Amount of Exudation	Phagocytic Index	Time Autopsy
	c.c.	*c.c.*		*Days*
Paraffin oil.....	100	150	3: 14	7
Paraffin oil.....	100	200	4: 15	4
Paraffin oil.....	100	200	4: 16	4
Paraffin oil.....	100	125	3: 17	8
Paraffin oil.....	100	160	0: 16	12
Glymol.....	80	60	8: 10	3
Glymol.....	90	25	0: 12	28

Another interesting fact in respect to oil is noted in that during the first four days following the injection of oil there is an excessive amount of exudation of fluid into the cavity, then in the next four days there seems to be a decrease in the amount of fluid, followed in the last four days of a twelve-day period by again increasing amounts. The explanation of this, of course simply a theory, is that the presence of the oil in the abdomen primarily calls forth an intensive cell exudation. In the process of adjustment absorption begins and the amount is temporarily decreased, but as soon as absorption begins, the lymphatics become plugged with oil and cell detritus and the further increase in the exudation is held within the cavity. This condition then remains for a long period, extensive exudation being present three weeks to a month after operation. That the oil is gradually absorbed by the lymphatics is shown by the presence of oil droplets in the lymphatics of the mesentery and broad ligaments in cases allowed to go for a long period.

From our experiments with the use of citrate solutions involving seven cases, there is not a single satisfactory result. Two deaths occurred, one resulting from peritonitis, the other from the splitting open of the abdominal wound.

In all the other cases, five in number, the results are surprisingly similar, adhesions being noted in all instances, while a minor grade of peritonitis was present in one. In none of these cases was there satisfactory wound healing. This would certainly contra-indicate the use of such solutions in clinical work. Our results with the use of citrate solution in dogs are just opposite from the results which Pope obtained with the same solution in rabbits; in his work adhesions were limited and wound healing normal.

This we take to be due to the fact that we were working in areas where the gut had to be opened, thus exposing the area to the chance of infection, a factor not to be unconcernedly thrown aside. It is also probable that this procedure limits the normal production of plastic lymph so that seepage takes place through the lines of intestinal sutures, and a minor degree of infection follows which results later in the production of adhesions, though there is not enough infection present in all cases to give a definite peritonitis. The disagreement of our results with those of Pope's may be due to the fact that he did his work on rabbits, the peritoneum of which is generally known to be very resistant to infection, and that he was working under the artificial condition of the exclusion of possible infection. While we are not inclined to draw final conclusions, we would say that citrate solution is not indicated in cases where infection may be present, though it may have a field in those cases where infection can certainly be excluded; we would call attention in such cases, *i.e.*, where the adhesions are broken up without opening a certainly infected area—such as an abscess or the intestine—to the great danger which would follow if a focus of even mild latent infection were opened in the presence of a citrate solution. This statement is based upon the experimental evidence that the first step in the removal of infection from the peritoneal cavity consists in a gluing of the bacteria to the omentum—a process with which the citrate would certainly interfere.

These conclusions are almost identical with those reached by Momburg after using injections of oil in 16 clinical cases. Coffey also has lately expressed the same views in the use of oil.

The process underlying the formation of adhesions is a part of the process of the normal repair of all wounds of serous surfaces consisting, as pointed out above, in the outpouring of a plastic lymph which seals the lips of the wound. The problem therefore is not the prevention of adhesions, but the limitation of adhesions; if the outpouring

of this plastic lymph be entirely prevented, the wound is not sealed and the entrance of bacteria from the intestinal lumen into the peritoneal cavity is unhindered.

This problem of limiting adhesions therefore becomes the somewhat delicate problem of permitting the necessary adhesions and preventing the unnecessary ones. It does not seem to us that this delicate line can be drawn by the use of any chemical or physical method such as citrate or oil, and we return to the point so often reached by the surgeon, after some new idea has fostered false hopes, that all wounds of the peritoneum must heal by a process of lymph formation, which when carried too far means adhesions; therefore the only method of limiting adhesions is to limit the wounds of the peritoneum. The results of the work we here report show that this can be done by careful technic and by covering the necessary wounds with freed or attached portions of the omentum or mesentery.

The most practical method for limiting adhesions consists in the clear understanding of the operator that the peritoneum is not a structure which can be cut and sewn, but a single layer of delicate endothelial cells; that the biologist obtains these cells for study by gently wiping the peritoneal surface with a gauze sponge, then pressing this sponge on a cover glass; and that every wound of this layer of cells begins to heal by the fundamental process of adhesion formation —the outpouring of a plastic lymph.

Dr. George G. Ross said that it seemed to him very evident that the formation of adhesions is a beneficent act of Nature to prevent the spread of infection, and that prevention of adhesions is not always an advantage to the individual. The excess of adhesions is a different problem, and a most serious one in surgery. When adhesions become a menace to the patient by causing obstruction, changing the position of, or interfering with, the mobility of organs and by recurring after being broken up, they form a problem which is still unsolved, and one of vast importance. The paper, however, does not seem to throw any light upon the immediate solution of this problem. I should like to ask how we may prevent this type of adhesions.

Dr. A. Bruce Gill called attention to another class of cases in which intestinal adhesions occur that may lead to the death of the patient. When a general peritonitis follows the rupture of a gastric or duodenal ulcer, adhesions are formed between the loops of gut and between the gut and the parietal peritoneum. Thus localized collections of pus are formed that are not drained by gravity. Such collections

may be found beneath the spleen while the patient has been kept in the sitting posture and suprapubic drainage maintained. Death occurs from absorption from these peritoneal abscesses that are undrained. The problem seems to be to prevent the formation of such collections of pus by preventing peritoneal adhesions during the acute stage of general peritonitis. With this object in view, in his last case of ruptured duodenal ulcer with evidence of general peritonitis he flushed out the peritoneal cavity with a solution of sodium citrate, 1 per cent., and sodium chloride, 2 per cent., at the time of operation; and proposed to repeat this procedure at intervals by pouring the solution into the upper abdominal wound and allowing it to escape from the suprapubic wound. However, the patient was in such degree of shock on his admission to the hospital that he died an hour after the operation was completed.

It seemed to him that the objections to the use of citrate solution mentioned by Dr. Sweet do not hold in cases of general peritonitis, where free drainage is essential to the recovery of the patient and where adhesions prevent such drainage in spite of the force of gravity.

If the closure of the perforation in the gut should be delayed by the presence of the citrate, this would not be an insuperable difficulty.

Dr. A. P. C. Ashhurst inquired whether Dr. Sweet employed a 3 per cent. solution of citrate in normal salt solution, or if he used the 2 per cent. solution of sodium citrate in a 3 per cent. (hypertonic) salt solution, as advised by Saxton Pope himself.

Dr. Chaney, in closing, said that they used the 3 per cent. citrate in normal saline because that was the solution used by Koch in his work upon rabbits and with which he found very satisfactory results.

ARTERIOVENOUS ANEURISM OF THE FEMORAL ARTERY AND VEIN

Drs. Edward B. Hodge and J. E. Sweet reported the following case because of the relative infrequency of the condition present and the favorable result so far obtained by modern surgical methods.

C. M., aged twenty-nine years, was referred to the service of Dr. Hodge at the Presbyterian Hospital, May 19, 1914, by Dr. E. H. Goodman with the diagnosis of arteriovenous aneurism of the left femoral artery. In May, 1898, while cleaning a revolver, he accidentally shot himself, a .32-calibre bullet entering the inner side of the left thigh about its middle, and being later removed from beneath the skin on the outer aspect.

There was free bleeding, spurting to a height of 12 inches. He

walked downstairs, fainted, and soon the hemorrhage ceased. With no ligatures and simply an occlusive dressing, the wound healed after two weeks in bed. A year later, he noticed a pea-sized lump at the point of entrance and also began to have a sensation in the leg described as "buzzing." Two years ago—14 years after the accident—the leg began to swell and in the last year this has increased markedly. With the enlargement has gone an increase in the "buzzing" sensation. The latter is noticed only at night and, with the marked pulsation and throbbing now present, keeps him awake. There is no actual pain or tenderness present.

The general physical examination by Dr. Goodman reveals nothing abnormal except a slight apical systolic murmur transmitted to the angle of the scapula.

The left thigh is somewhat full. From about 5 cm. above Poupart's ligament to the small scar at mid-thigh is an irregular, soft swelling following the line of the vessels. Over this swelling is noted a strong, expansile pulsation, a marked thrill and a loud to-and-fro murmur.

The latter is conducted well into the leg, being heard distinctly half way to the ankle. Pulsation is present in both tibials. The right thigh measures 42 cm.; the left 46 cm. The Wassermann was negative.

It seemed a good opportunity to have the benefit of the skill in vascular surgery possessed by Dr. J. E. Sweet, Professor of Experimental Surgery in the University of Pennsylvania. Dr. Sweet kindly saw the patient and, with Dr. Hodge's assistance, operated as described below. It is to be noted that at operation both artery and vein were found enlarged, the vein much more so. To the dilatation of the latter is to be ascribed the swelling of the thigh in the last two years finally involving the external iliac.

Convalescence was marked only by a rather higher temperature range than might be expected. There was aseptic healing. From the time of operation, the patient had no trouble with the leg, sleeping well. Pulsation, thrill and murmur were absent. On June 5, the left thigh measured only 0.5 cm. more than the right. When last observed, August 27, the patient felt perfectly comfortable and local conditions were as noted in June.

Dr. Sweet added that the choice of the method to be followed in an operation for arteriovenous aneurism will depend upon the peculiarities of the given case, and may indeed depend upon the condition there found after more or less extensive dissection on the operating table. In the present case a pulsating tumor existed, extending from a little below the scar of the traumatism at the middle of the thigh to

well above Poupart's ligament. An extirpation could not be considered and the quadruple ligation of classic recommendation would have to be undertaken upon diseased vessel walls.

The only tenable suggestions were the separation of the vessels with sutures of the resultant longitudinal wounds, or simply closure of the connecting channel with no attempt at separation. There seemed to be no reason for the extended dilation of the vessels except the mechanical disturbance of the blood current; the patient was young, did not show any evidence of general arteriosclerosis, gave a negative history as to syphilis and alcohol. It was therefore argued that since no other explanation could be found for the enlargement of the vessels than the disturbed course of the blood stream, the correction of this disturbance would result in the healing, or at least marked reduction in size, of the enlarged vessels. After the vessels had been dissected out and the communicating channel found, a small clamp was applied to this channel (Fig. 4); the thrill immediately ceased and pulsation in the vein was no longer felt. The vessels were adherent for about 1½ inches. The actual communication appeared to be about ¾ inch in length.

The channel was permanently closed by a row of fine silk interrupted sutures, passed through and through at the side of the clamp, and the clamp was removed. This was done without attempting to control the blood current except by placing an Esmarch bandage in position to meet any possible accident. The last suture cut through at the upper angle and a slight hemorrhage occurred, which was controlled by proximal digital pressure and stopped by placing another suture. This incident emphasizes a point not made sufficiently clear, if even mentioned in the articles on aneurism, namely, the difficulty of suturing the walls of a diseased artery or vein. It is not difficult to obtain beautiful experimental results on normal vessels; but it is positively dangerous to transfer these results to diseased blood-vessels. This tissue will not hold the fine sutures nor can it be depended upon to hold sutures for any length of time, even when the sutures may seem to be successful at first; secondary hemorrhages have often occurred.

These remarks do not necessarily apply to the Matas method of dealing with a true aneurism, where layer after layer of sutures can be applied to the diseased vessel wall. Excision of the vessels and direct anastomosis of their ends might well be possible, and was indeed done by Murphy in 1897. The cases where this idea is practicable are rare, and the method can only succeed where the vessel walls are relatively normal, as they were in Murphy's case—a recent gun-shot injury. Lateral suture of the vessels is likewise not promising because of the

friability of the vessel walls, except perhaps in a case in which a large sac existed between the vessels which could be pleated over the lateral sutures of the vessel walls.

In this case the vessel sheaths and all the available surrounding tissue was brought over the vessels in several layers to bring pressure upon the vessels as far as exposed. Stewart, of New York, had succeeded in one case with a similar technic.

The order of choice of method to be decided for each individual case, perhaps not until the operation can disclose the exact relations of the vessels, is (1) the simple ligation of the connecting channel, if this be small enough to permit a closure by ligation, if not, its closure by one or more rows of sutures passed through both walls of the intercommunicating channel; (2) in the presence of a definite sac between the vessels, or as a part of one vessel, to restore the contour of the

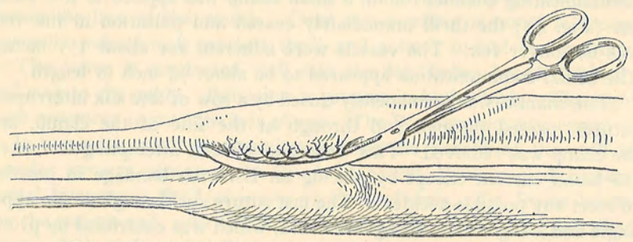

FIG. 4.—Clamp and suture of anastomotic ridge between artery and vein.

vessels by rows of sutures placed from the outside and plicating the sac over these sutures for support; (3) if the vessels show little evidence of disease, resection and end-to-end anastomosis, although this type of case would probably be the most suitable for the method first described, and (4) as a measure of last resort, quadruple ligation.

DR. GWILYM G. DAVIS said that he saw a case some years ago in a child in which, while a physician was doing a circumcision, a movement of the child threw the knife on the thigh, puncturing the vessels. Subsequently an arteriovenous aneurism occurred and he was brought to him at the age of nine or ten on account of marked difference in length of the two extremities. The leg in which the arteriovenous aneurism had occurred was much longer than the other. In other words, apparently the arteriovenous communication had increased the growth very much. Of course, when a person is in the period of growth, a difference in the nutrition of the two limbs would tend to make a difference in their length. Beyond the period of growth, however, it is not to be expected that there should not be any difference in length. It is interesting to know that the transference of arterial blood into venous channels has a marked effect on the growth of a limb. If this could be done at will it would be a desirable means of increasing the length of the shortened limb in certain cases, such as occur after hip disease and various other disabilities.

DR. JOHN B. ROBERTS said that it had seemed to him for many years that "arteriovenous fistule" was a better term for this condition than arteriovenous aneurism. His experience was limited to one case years ago, in which he had the whole leg slough after an operation done by the then ordinary method of arterial ligation. Amputation was necessary, and death occurred.

DR. HODGE, in closing, said that the condition could very accurately be described by the term suggested by Dr. Roberts. The communication between the two vessels looked like a gastro-enterostomy opening. The opening was too large to ligate and the suggestion made by Dr. Sweet seemed to be the better method.

DR. SWEET added that the two vessels which were uniformly enlarged were joined together toward the lower end of the enlargement by a channel about one and a half inches long. The vessels were dissected out until he could pass his finger behind the channel, and then the little clamp was placed as shown in the diagram; the pulse immediately returned in the arteries below the site of operation, even in the arteries of the foot. Then he made this closure permanent by inserting a row of interrupted sutures. From Dr. Davis's description of his case he inclined to the idea that one leg grew more than the other because of better blood supply, although he was not able to understand under the conditions how there would be a better blood supply.

SOME EXPERIMENTS ON THE SURGERY OF THE PANCREAS

By Joshua Edwin Sweet, M.D.
and
I. H. Simons, M.D.
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(From the Laboratory of Surgical Research, University of Pennsylvania)

In 1909 Coffey [1] published a series of experimental operations designed to prepare a new exit for the external secretion of the pancreas applicable to cases in which the pancreatic ducts are occluded because of some pathological process in the head of the organ. The pancreas is not infrequently attacked by the pathological processes common to such glandular structures, notably benign and malignant tumor growths and by inflammation; the diagnosis of these conditions has made noteworthy progress, but the actual surgery of the pancreas seems to be limited to either indirect drainage through the gall-bladder, or, more rarely, direct drainage of the gland. The laboratory worker has little respect for the pancreas, and the fact that so much of our knowledge concerning the function of the organ is based on the experimental surgery of physiologists justifies the thought that the pancreas is able to withstand as much surgical maltreatment as any other vital organ.

Our studies were undertaken at the suggestion of Dr. Edward Martin without at first a knowledge of Coffey's previous work. Our conception was far more simple than the extended and elaborate procedure of Coffey, and our results seem worth communicating, because they fully support Coffey's conclusions concerning the surgical possibilities of the pancreas and because they offer a technic so simple that it could be executed with a trivial loss of time.

The condition in which such an operation would be indicated is in general that of a blocking of the pancreatic duct; in particular as seen in (1) carcinoma of the head of the pancreas; (2) carcinoma of the ampulla of Vater and the lower part of the common duct; (3) adenoma and chronic interstitial pancreatitis of the head of the pancreas; (4) cysts of the head.

The ducts of the pancreas are valveless. The direction of flow of

[1] Coffey, Annals of Surgery, 1909, i, 1238.

the pancreatic juice can be reversed in the larger ducts, as is seen in the attempts to form a permanent pancreatic fistula in the dog. The pancreas of the dog always possesses two ducts opening into the intestine, a major duct, opening apart from the bile duct and draining the greater part of the organ, and a minor duct, opening at or near the ampulla of Vater and draining an independent island of tissue, but both systems anastomosing, so that a cannula placed in the major duct will not supply the investigator with pancreatic juice unless the minor duct be tied.

The pancreas of the dog corresponds in a general way to the human organ, with the addition of a process extending down the intestine from the head, called the processus uncinatus.

Our first experiments were to determine if a part of the pancreas could be separated from the remainder of the organ and successfully implanted in the gut. The processus uncinatus was cut off from the head of the organ, the duct in the proximal stump ligated, and the end of the uncinate process simply implanted in the intestine by dropping it through a longitudinal slit in the gut, which was then carefully closed by fine sutures. The best technic for this procedure appears to be in detail as follows: The pancreas is fastened to the intestine by a continuous suture placed about one-half inch from the cut end of the pancreas. This suture is carried around that half of the circumference which will lie beneath the organ, since that part is most difficult of access.

The intestine is then opened by a longitudinal slit, one-half of which wound lies within the area enclosed by this continuous suture. The pancreas is inserted into the lumen of the gut and the continuous suture completed about the remaining half of the pancreas, or in other words the technic corresponds to the first and fourth rows of sutures in a gastro-enterostomy. The three animals in this series were autopsied after six, five and four weeks. In all three cases the duct in the implanted portion was patulous and of normal size. In two there was no apparent atrophy of the pancreatic tissue. One had atrophied to one-third of the original size; microscopic study of the tissue showed no abnormalities. There was no fat necrosis, perfect anastomosis, and a very few adhesions. The other part of the pancreas was of course entirely normal.

In the second series of three animals an artificial obstruction was attempted by ligature of the ducts with implantation into the intestine of the proximal end of the pancreas after cutting off the uncinate process.

The first dog was autopsied after five weeks, and it was found that the new opening into the gut had closed, while a new duct had formed around the ligature of the major duct. The second dog died a week after the operation, from distemper pneumonia, and even in this short time a new duct had formed around

the ligature of the duct. The third dog, autopsied after five weeks, showed the same result—a new duct circumventing the ligature of the duct. None of these cases showed any gross changes in the organ, no pancreatitis, fat necrosis, or atrophy.

In the third series the pancreatic ducts were cut between ligatures and the omentum was interposed between the ends of the ducts in an attempt to prevent the re-formation of these ducts. The proximal stump, after excision of the uncinate process, was anastomosed with the intestine by the same simple procedure outlined above. This operation was tried in two cases which were autopsied four weeks after operation. The implanted duct was patulous. The ducts had not re-formed and there was no evidence of pancreatitis, nor fat necrosis, nor atrophy.

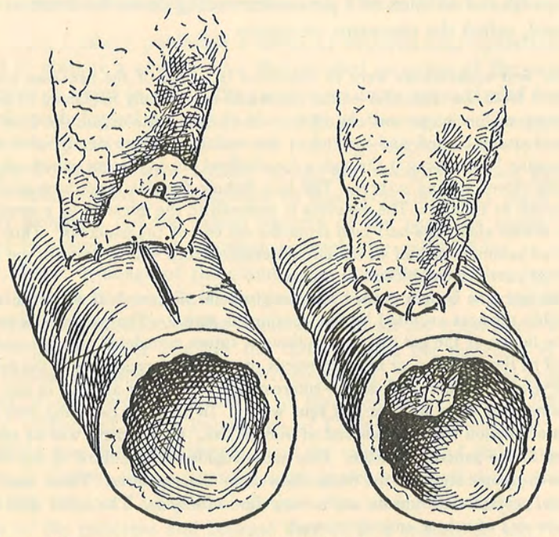

FIG. 1.—Diagrammatic representation of the method of inserting pancreas into bowel.

The persistency with which the pancreatic ducts reëstablished themselves in the second series, and the well-known digestive action of pancreatic juice on the edges of a fistula led us to vary our technic in the third animal of this series in that the cut end of the pancreas, after blocking the ducts by interposition of omentum, was implanted in an opening of the gut which extended simply to the mucosa. We wished to see, in other words, if the pancreatic juice would provide an opening for itself through the mucous membrane. This animal died at the end of a week, the autopsy showing acute necrotic pancreatitis with fat necrosis and occlusion of the duct at the site of implantation.

The results of experimental studies can be judged either on the basis of the perfect uniformity of the results obtained in a relatively small series, or on a percentage basis of a large series. The number of the experiments described here is small, but the results are so entirly uniform, if we disregard the last animal, in which because of the modification of technic an entirely new problem was introduced, that we may safely conclude, first, that the pancreas can be anastomosed to the intestine by a simple technic; second, that there is little probability of pancreatitis, with its immediate dangers or its final result of atrophy; third, that the new opening into the gut will functionate, provided the normal openings are effectively obstructed.

EGGSHELL FRACTURE (INFRACTION) OF HEAD OF SECOND METATARSAL

DR. PENN G. SKILLERN, JR., reported the case of a woman, aged forty years, who stubbed the second toe of her right foot against the floor. Clinical examination revealed swelling and "wincing" tenderness at the head of the second metatarsal bone. Skiagram (Fig. 5) revealed a loss of the normal convexity of the articular surface of the head of the second metatarsal bone, there being instead an irregularly flat surface with broadening of the head. The lateral view (Fig. 6) clearly reveals an oblique indentation, which resembles that of the proverbial egg of Columbus. There were no loose fragments. Treatment consisted in the application of a pad to the sole of the foot behind the head of the second metatarsal bone so as to keep the involved area clear of the ground, and thus free from the pressure of the body.

Dr. Skillern said that this is the seventh case of this injury on record. Freiberg (*Surg., Gynec., and Obstet.*, 1914, xix, 191) first called attention to the injury and reported six cases, all occurring in women. These patients had stubbed their toes in some manner, in two while playing tennis. They complained of pain in the ball of the foot in weight-bearing only. Freiberg suggests the following mechanism: "Under normal circumstances the second metatarsal bone is slightly longer than the first. In the presence of a diminished power of toe flexion, especially of the great toe, it is apparent that forcible impact against the ground of the ball of the foot, which is not sufficiently guarded by the flexor power of the toes, will cause the exposed distal end of the second metatarsal to bear the brunt of the blow."

The diagnosis must be made from metatarsal pain due to static weakness, and this is probably the reason why more cases have not been discovered. The rule is that in static weakness both feet are

involved. Metatarsalgia or Morton's toe usually concerns the fourth metatarsal, and is paroxysmal in nature. There may be a history of having stubbed the toes. By reason of its close proximity it seems to the writer that fracture of the external sesamoid of the hallux must also be ruled out, but the mechanism of this injury is quite different.

The treatment consists in the use of a pad applied to the plantar surface of the foot by means of adhesive plaster, so that its anterior end is placed just back of the injured point. If there are loose bodies their removal by arthrotomy is necessary, unless few in number and very small.

It seemed to the reporter that the term "infraction" is undesirable. We are in reality dealing with an impacted fracture. In the mechanism and in the effect upon the oval head of the bone one is forcibly reminded of the proverbial manner in which Columbus solved the problem of making an egg stand on end, and for this reason, as well as the similarity of the compact layer of bone of which the periphery of the head is composed, he suggests the term "egg-shell fracture" as being more appropriate and descriptive.

FRACTURE OF PROCESSUS POSTICUS TALI WITH FRACTURE OF CALCANEUM

Dr. Skillern reported the case of a man, aged thirty-eight years, who fell in a tank, injuring his right foot, for which he was admitted to the University Hospital, service of Dr. Charles H. Frazier. Clinically, bony landmarks were obscured by great swelling, but there was "wincing" tenderness along the fore part of the calcaneum, a fracture of which was suspected. Skiagram (Fig. 7) revealed a comminuted fracture of the antero-inferior portion of the calcaneum. It also showed a fracture of the processus posticus of the astragalus, probably from the impact of the dorsum of the calcaneum. The usual treatment of fractures about the foot was instituted.

According to Stimson (*Fractures and Dislocations*, 7th ed., 1912, 459) fracture of processus posticus tali was first mentioned by Cloquet, in 1844. Lilienfeld (*Archiv. f. klin. Chir.*, 1905–1906, lxxviii, p. 945) says the combination of fracture of the calcaneum with fracture of the processus posticus tali, as in this case, is by no means rare, and that isolated fracture of the processus posticus tali occurs more frequently than is diagnosed. Of 600 fractures observed by him at the Zander-Institut, there were 7 isolated fractures of the processus posticus tali and 5 in conjunction with fracture of the calcaneum.

The cause of fracture of the processus posticus tali is a fall upon

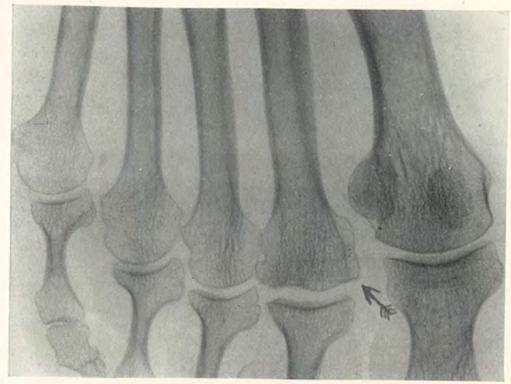

Fig. 5.—Infraction (egg-shell fracture) of head of second metatarsal. Note flattening of articular surface, and compare with normal convexity at heads of uninjured metatarsals (antero-posterior view).

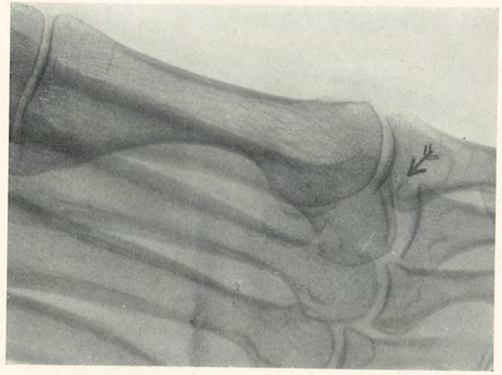

Fig. 6.—Lateral view of Fig. 5. Note oblique indentation.

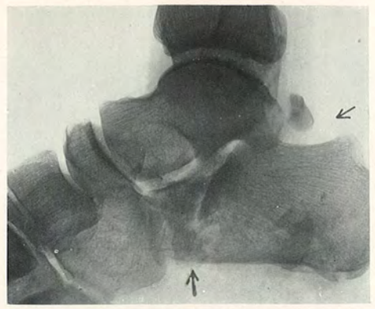

FIG. 7.—Fracture of processus posticus tali with fracture of calcaneum. Note diminished density of that part of astragalus from which process is separated (lateral view).

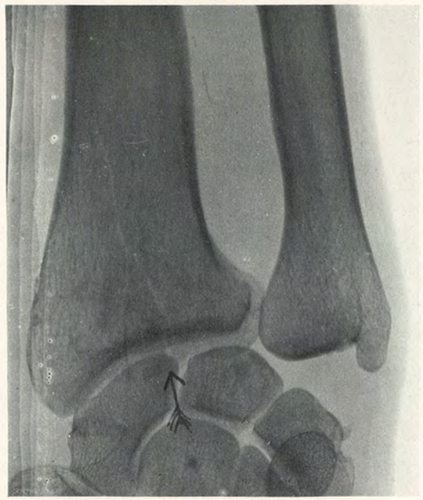

FIG. 8.—Longitudinal fissured fracture of lower extremity of radius. Beginning at ridge on inferior articular surface between the quadrilateral and triangular facets the line extends obliquely upward and outward 4 cm., to disappear .5 cm. internal to outer border of radius.

the heel with the foot in plantar flexion, thus impacting the calcaneum against the process. The clinical diagnosis is made by the history of the injury and localized tenderness elicited by deep pressure with the finger above the external attachment of the tendo achillis. There may also be a slight concavity of this tendon just above its insertion.

Stimson and others confuse fracture of the processus posticus tali with the inconstant os trigonum. Thus, Stimson quotes Lilienfeld as having observed 12 fractures of the os trigonum, whereas a reference to his article shows that it was the processus posticus tali that was fractured. The same error had been made in the case that I report.

The processus posticus tali is the posterolateral projection of the astragalus, the lateral tubercle of anatomists, which bounds externally the sulcus for the tendon of the flexor longus hallucis muscle.

The os trigonum, or intermedium cruris, on the other hand, lies in the second month of fetal life as an anlage of hyaline cartilage between the distal ends of the tibia and fibula, and has the shape of a triangle with the apex directed proximally and the base distally. Normally it remains independent for only a short time, uniting to the astragalus. In 3 per cent. of cases it persists as an independent bone. Aside from man it is found among mammals only in the wombat. When persisting it is always situated behind the astragalus, from which it is separated by a slight fissure, and is oval in form, measuring 20 by 15 mm. It is present on both sides, and has the peculiarity of being usually rudimentary on one side. It was first described by Rosenmuller in 1804.

He had not been able to find an instance of fracture of the os trigonum. The question is whether the fragment found is a fractured processus posticus tali or a normal, though inconstant, os trigonum. A study of the skiagram shows a definite vertical plane of fracture, with diminished density of that part of the astragalus from which the processus posticus was broken off.

LONGITUDINAL FISSURED FRACTURE OF LOWER EXTREMITY OF RADIUS

DR. SKILLERN presented a skiagram which he said was obtained in the Surgical Out-Patient Department of the University Hospital, but the patient did not report after visiting the Receiving Ward, probably because of slight symptoms, and therefore no history was obtained. It shows a fissure beginning at the ridge on the inferior articular surface of the radius between the quadrilateral and triangular facets and extending obliquely upward and outward 4 cm. to disappear 0.5 cm. internal to the outer border of the radius (Fig. 8).

This is the ninth case of the injury on record, if we wish to include that reported by Wilhoit (*Jour. A. M. A.*, 1913, lxi, 770) as a longitudinal fracture, but which in reality cuts off the ulnar corner of the radius. Writing in 1910, Cotton states: "So far as we know this fracture is the result of direct violence by crushing. It is very rare; three specimens constitute the total of the evidence." As in other longitudinal fractures it may be suspected clinically by a line of "wincing" tenderness.

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Dr. Skillern presented a skiagram (Fig. 10) which showed, in addition to the usual epiphysis at the head of the bone, an extra epiphysis at the base, the centre of which is uniting with the shaft.

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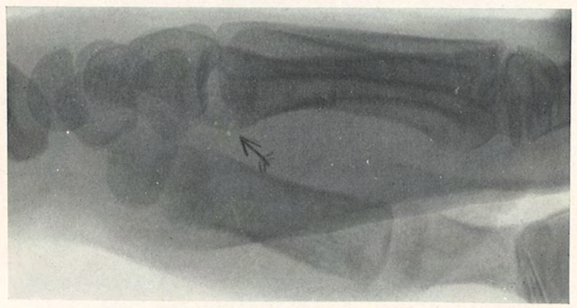
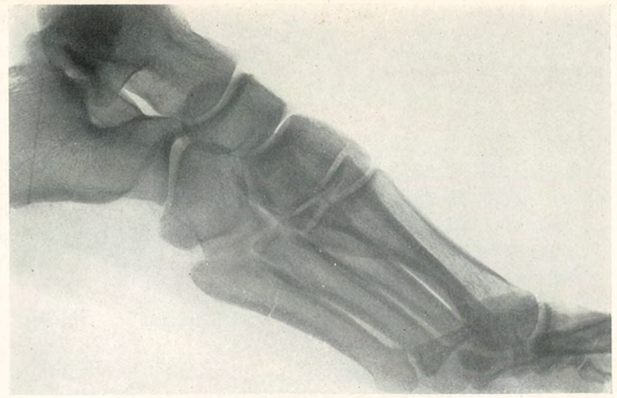


FIG. 11.—Lateral view of Fig. 10.

A



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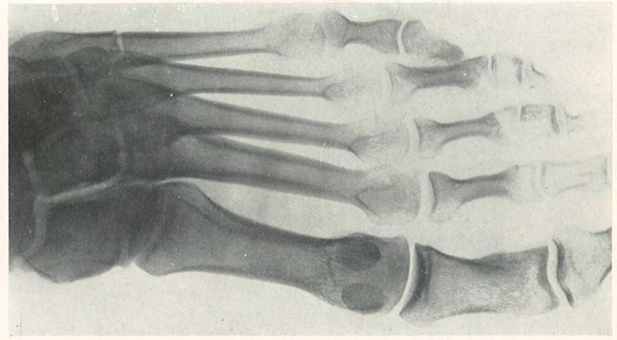

FIG. 12.—Case I.

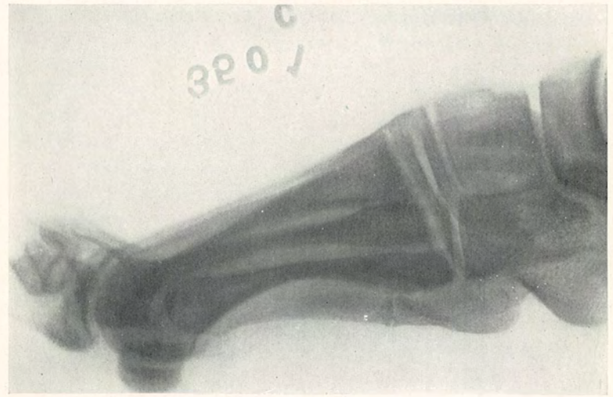

FIG. 13.—Case II.

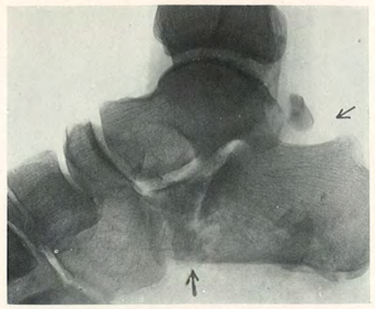

FIG. 7.—Fracture of processus posticus tali with fracture of calcaneum. Note diminished density of that part of astragalus from which process is separated (lateral view).

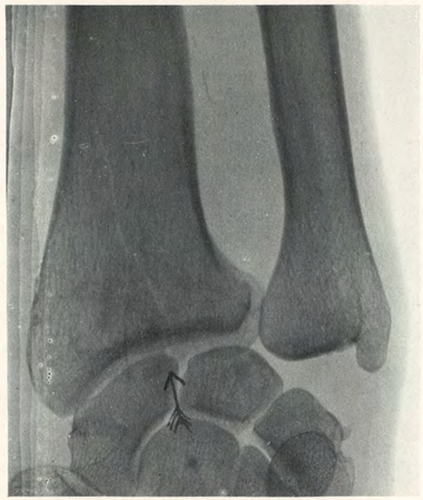

FIG. 8.—Longitudinal fissured fracture of lower extremity of radius. Beginning at ridge on inferior articular surface between the quadrilateral and triangular facets the line extends obliquely upward and outward 4 cm., to disappear .5 cm. internal to outer border of radius.

the heel with the foot in plantar flexion, thus impacting the calcaneum against the process. The clinical diagnosis is made by the history of the injury and localized tenderness elicited by deep pressure with the finger above the external attachment of the tendo achillis. There may also be a slight concavity of this tendon just above its insertion.

Stimson and others confuse fracture of the processus posticus tali with the inconstant os trigonum. Thus, Stimson quotes Lilienfeld as having observed 12 fractures of the os trigonum, whereas a reference to his article shows that it was the processus posticus tali that was fractured. The same error had been made in the case that I report.

The processus posticus tali is the posterolateral projection of the astragalus, the lateral tubercle of anatomists, which bounds externally the sulcus for the tendon of the flexor longus hallucis muscle.

The os trigonum, or intermedium cruris, on the other hand, lies in the second month of fetal life as an anlage of hyaline cartilage between the distal ends of the tibia and fibula, and has the shape of a triangle with the apex directed proximally and the base distally. Normally it remains independent for only a short time, uniting to the astragalus. In 3 per cent. of cases it persists as an independent bone. Aside from man it is found among mammals only in the wombat. When persisting it is always situated behind the astragalus, from which it is separated by a slight fissure, and is oval in form, measuring 20 by 15 mm. It is present on both sides, and has the peculiarity of being usually rudimentary on one side. It was first described by Rosenmuller in 1804.

He had not been able to find an instance of fracture of the os trigonum. The question is whether the fragment found is a fractured processus posticus tali or a normal, though inconstant, os trigonum. A study of the skiagram shows a definite vertical plane of fracture, with diminished density of that part of the astragalus from which the processus posticus was broken off.

LONGITUDINAL FISSURED FRACTURE OF LOWER EXTREMITY OF RADIUS

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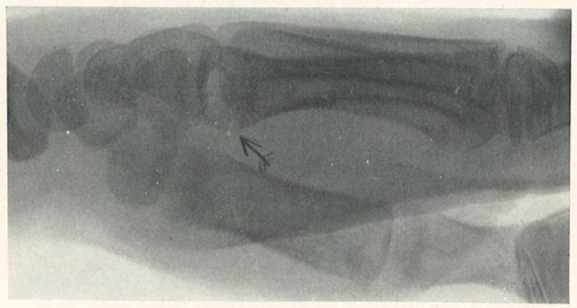
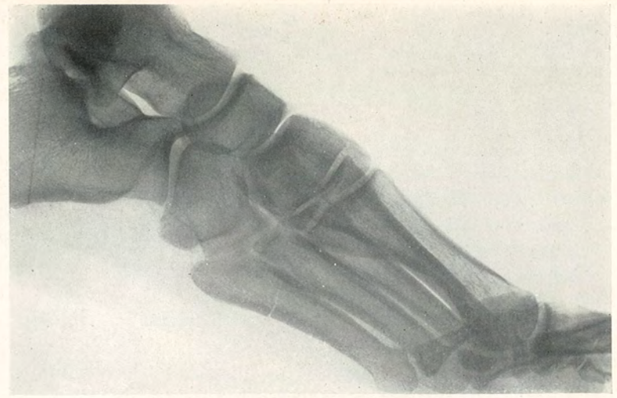


FIG. 11.—Lateral view of Fig. 10.

A



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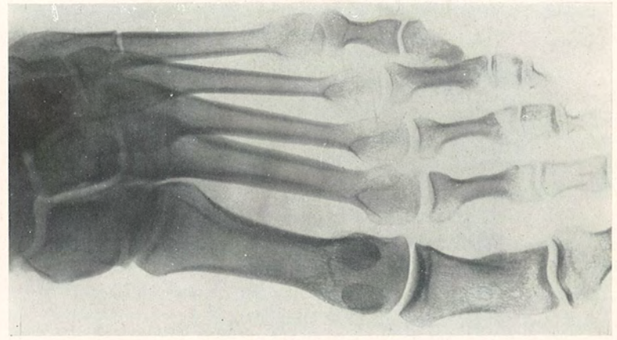

FIG. 12.—Case I.

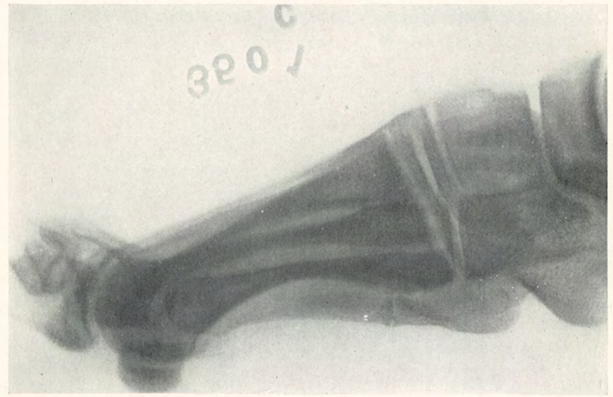

FIG. 13.—Case II.

The epiphysis may also be made out in the lateral view (Fig. 11). The writer's attention was called to this anomaly by Dr. H. K. Pancoast.

The first is the only metacarpal that has an epiphysis at its base normally, and for this reason it is considered by some as a phalanx, in which the epiphyses are always at the base. There is usually a scale-like epiphysis on the head of the first metacarpal, which makes its appearance about 8 or 10 and rapidly unites with the head. Rarely smaller epiphyses appear at the bases of the other metacarpals, as in mammals generally. There may be an independent centre for the styloid process at the base of the third metacarpal.

This epiphysis must not be confused with the occasional fusion of the trapezoid with the base of the metacarpal.

A similar case is pictured and described by Dwight in his work on "Variations in the Bones of the Hands and Feet."

FRACTURE OF BASE OF FIFTH METATARSAL

Dr. Morris Booth Miller presented skiagraphs of two patients with fracture of the base of the fifth metatarsal. In each the injury was due to indirect violence, the sudden imposition of the body weight while the foot was inverted and the heel raised. In this they are in accord with the cases previously reported by Robert Jones, Wharton, Coues, Cotton, Sylvester, and others, which show without exception that indirect stress is the responsible factor in all fractures of this type.

I. W. McC., aged twenty-five, while driving quickly stepped out of his carriage to avoid an accident. He stated that he was anxious to reach his horse's head and hence he was in the act of turning when his foot touched the ground. He felt a pain on the outer side of the foot but it was not severe and he was able to walk with very little discomfort. Diagnosis was by skiagraph which showed a fracture 3 cm. from the base. (Case I, Fig. 12, A and B.)

II. S. F., aged thirty-two, stepped from a ladder upon a hammer, which caused his foot to turn in, while at the same time he made a sudden effort to prevent a fall. Pain and partial disability caused him to seek hospital treatment. (Case II, Fig. 13.)

Dr. Penn G. Skillern, Jr., said the cause of this fracture by indirect violence is a sudden, sharp adduction of the foot, whether by dancing, jumping, or missing the last step of a ladder or staircase. Thus, the weight of the body comes down upon the outer border of the foot, turning the head of the metatarsal inward, and bringing a cross-strain to bear just in front of the broad basal portion of the bone, which is held firmly apposed to the similarly broad base of the fourth meta-

tarsal by very strong ligaments. Near the front of the broad base the metatarsal gives way (Cotton). There may be a fissure of the outer side only or a clean break across. Pain is not great, and the immediate disability is only partial. By pressing the neck of the bone inward pain is caused at the base. The alternative of fracture of the fifth metatarsal bone near its base by indirect violence is a luxation at its proximal articular surface, the avulsion showing as a distinct cleft in the skiagram.

The tuberosity at the base may be avulsed by the pull of the tendon of the peroneus brevis muscle. In 600 fractures Lilienfeld (*Archiv. f. klin. Chir.*, 1905–1906, 78, 929) found isolated fracture of the tuberosity but 5 times. This fracture must not be confused with the presence of an *os vesalianum*, first described by Vesalius in 1555. This is either an extra tarsal bone or a persisting epiphysis situated at the proximal and external part of the tuberosity. It is a shell-like bone, marked off by a groove on the plantar surface. It is not present beyond puberty. Like the os trigonum, it is exceedingly rare, and occurs on both sides. Coues (*Bost. M. and S. J.*, May, 1904) reports a case in which the os vesalianum was present.

BULLET LOCALIZER

Dr. David R. Bowen presented a new bullet localizer which he said, to be precise, was a new attachment to a localizer now in use.

The idea of using cross threads to replace the course of Röntgen rays and thus localize a foreign body originated with Mackenzie-Davidson of London.

Later, Mr. Edwin Kelly added the pointer rod which is now in general use.

Given a surgeon and a röntgenologist used to working as a team this has served well. Many, indeed very many, cases have arisen, however, in which, after the localization was made, the rod was found to point through an undesirable site for operation. The fact that this was usually due to faulty team work or inexperience in nowise lessened the annoyance. The device here exhibited aims to remove entirely the personal equation and to make the localization a matter of precision.

It is original, I believe, in that from a single Mackenzie-Davidson localization variations can be made at will without further röntgenization. It is also original in that an actual probe is a part of the apparatus.

The instrument consists of a series of aluminum bars joined together by thumb nuts so as to make a four-jointed bar, fifteen inches in length, capable of universal motion in a single plane. At one end is

a clamp which fits the Kelly pointer rod, while the opposite end carries a tubular probe carrier.

To use, the clamp is fitted to the rod at a distance above a permanent mark on the rod equal to the distance of the F. B. below the end of the rod, as determined by the usual method. The joined bar is then adjusted so that the probe will just touch the end of the pointer rod.

It is obvious that if, now, the clamp is moved down to the mentioned permanent mark, then the probe will point directly at the foreign body; that an indicator attached to the probe will indicate the depth of the F. B. in that direction just as does the indicator on the Kelly pointer; and also that the direction of the pointer can be changed repeatedly at will (see Fig. 14, A and B).

STATED MEETING, DECEMBER 7, 1914.

The President, Dr. John H. Gibbon, in the Chair

SNAPPING SHOULDER

Dr. Penn G. Skillern, Jr., presented a man thirty-two years of age, a horse-back rider, who was first seen by him two months ago. Three months previous to that time he had fallen from a horse, but it was not until some time afterward that he complained of pain. During examination there was noticed a marked "snapping" of the shoulder—a definite shock or jar—upon elevating the arm to right angle and upon dropping it; skiagram negative. Dr. Skillern said that he had been able to find but one similar case in literature. This is reported by Reich in 1913, at Frankfort. Upon operating Reich found an abnormal fissure between the short head of the biceps and the coracobrachialis muscles. He accounted for the snapping by assuming that in abduction of the arm one or other of the tendons caught upon the lesser tuberosity of the humerus. He furthermore thinks there is a small breach at birth between the two tendons and that the accident served to increase this gap. He, therefore, proposed the term "*Schnappschulter*," or snapping shoulder. The sound is best obtained by elevation of the arm.

FRACTURE OF CONDYLOID PROCESS OF MANDIBLE

Dr. Robert H. Ivy remarked that fracture of the condyloid process of the mandible, while not extremely rare, is only occasionally met with, and receives little consideration in works on surgery. Most of the textbooks give the briefest possible mention to the injury. Nearly all cases occur by indirect violence, from an upward blow on the anterior portion of the opposite side of the lower jaw. Roe[1] states that in 41 cases of fracture of the mandible examined by him 6 were through the condyloid process, an unusually high proportion of almost 15 per cent. Egger[2] has compiled statistics from various sources, giving the frequency of this fracture as 4.5 per cent. in 365 cases of single fracture of the mandible. In combination with other fractures of the lower jaw, fracture of the condyloid process occurs more frequently, the proportion of cases of multiple fracture with this injury being about

[1] Roe, W. J.: Annals of Surgery, August, 1903, p. 221.
[2] Egger, F.: Beitr. fur klinisch. Chir., 1913, lxxvii, 294.

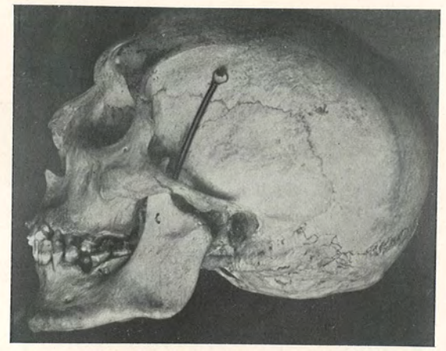

Fig. 1.—Skull, showing fracture of condyloid process of mandible (Cryer).

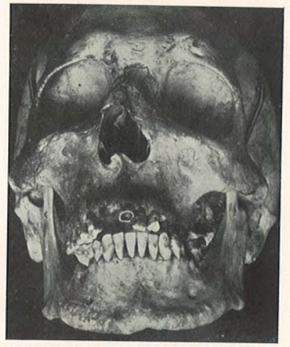

Fig. 2.—Anterior view of skull shown in Fig. 1. Horizontal displacement of condyle is seen on left side (Cryer).

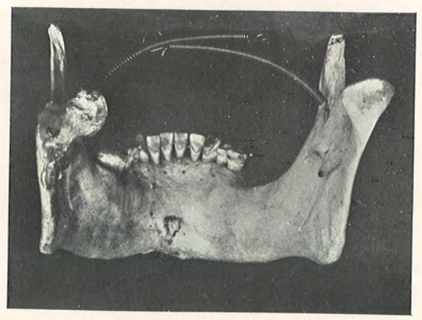

Fig. 3.—Posterior view of disarticulated mandible, showing typical deformity in fracture of left condyloid process (Cryer).

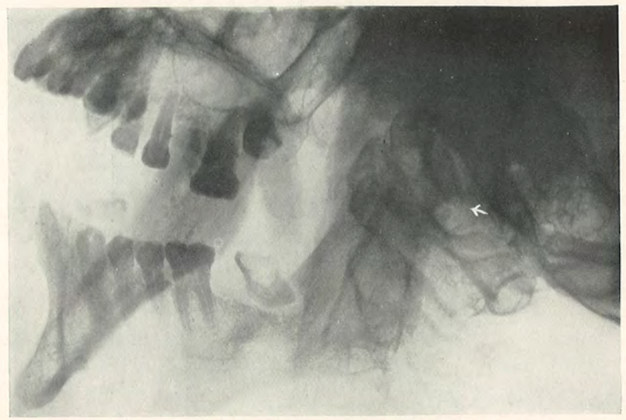

FIG. 4.—Lateral view, showing fracture of left condyloid process of mandible. (Röntgenogram by Dr. Pancoast.)

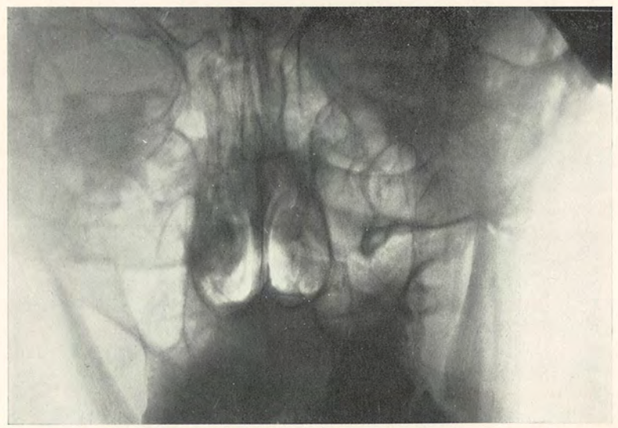

FIG. 5.—Anteroposterior view, showing fracture of left condyloid process of mandible. (Röntgenogram by Dr. Pancoast.)

10 per cent., according to Egger's figures. But in counting the total fractures in these cases the percentage falls to about 5. Of 45 cases of fracture of the mandible recorded at the Philadelphia General Hospital from 1904 to 1908, together with at least 20 others personally examined by the writer within the last four years, only one—to be reported here—was of the condyloid process, a proportion of less than 2 per cent.

Roe, together with other writers, speaks of the frequency of this injury as a cause of ankylosis of the temporomandibular articulation. It would appear that no attempt has been made to classify the fractures as extracapsular and intracapsular. This distinction is of some importance, as the extracapsular fractures would naturally not be so liable to be followed by ankylosis as the intracapsular.

Egger states that fractures of the condyloid process generally occur without displacement, since the fragments are usually held in contact by periosteum and soft tissues. That displacement does frequently occur is borne out by two specimens from the collection of Dr. M. H. Cryer, each of which shows the typical deformity found in these cases (Figs. 1, 2, and 3). The condyle is seen to be drawn forward and inward by the external pterygoid muscle, bringing the upper fragment into a transverse and horizontal position, the portion of the process below the fracture being pulled upward and outward by the masseter, union having taken place with the fragments in this position without ankylosis. One of these specimens well illustrates also the deviation of the chin toward the injured side, first mentioned by Heath.[3]

The following case has recently been under the writer's care:

C. B., aged fifty-eight; male; white; teamster. Was kicked by a horse on the chin to the right of the median line. This resulted in an area of pain and tenderness at the place where the blow was received, and in a second area of pain and swelling on the left side of the lower jaw above the angle. The pain in the latter region was increased by attempts to open the mouth, which could only be done with difficulty. The patient applied for treatment at the Surgical Out-Patient Department of the University Hospital, on May 27, 1914, the day after receiving the injury. Examination showed some contusion of the soft parts in the canine region of the lower jaw on the right side. No crepitus or other signs of fracture were found in this region, and the X-ray was also negative. On the left side, there was a moderately extensive, puffy, tender swelling just below the zygoma imme-

[3] Heath, Christopher: Injuries and Diseases of the Jaws, 4th Ed., 1894.

diately in front of the ear. Deep pressure elicited a point of greatest tenderness just below the normal position of the condyle of the mandible. The lower jaw was not fixed, but could be moved up and down with difficulty. Crepitus was felt at the point of greatest tenderness when this was done. On pressure over the region of the condyle when the jaw was opened, the normal forward movement of the condyle could not be felt. The lower incisor teeth were seen to be deviated toward the left side about half the width of a tooth. The X-ray (Figs. 4 and 5), by both lateral and anteroposterior views, showed a fracture through the left condyloid process of the mandible, somewhat low down, away from the head of the bone. In the lateral view, the upper fragment was apparently drawn forward, producing angulation at the site of fracture.

Treatment.—In view of the very slight deformity present, it was thought advisable to treat the case, at first at least, by simple restriction of movement by means of a modified Barton bandage, not too tightly applied, with instructions to the patient to use the jaw with moderation. By this means it was hoped that ankylosis would be avoided, though it was not greatly feared, as according to the X-ray and clinical signs the fracture was apparently extracapsular. As time went on, no other treatment was found necessary. The condition steadily improved, at the end of five weeks all bandaging was discontinued, the patient was free from pain, and could open the jaws to the normal extent. The very slight deviation of the chin toward the injured side remained, but caused no inconvenience. The condyle probably remained out of its normal position in the glenoid fossa, as a slight depression could be felt in this region instead of the usual prominence.

The case appears worthy of note, particularly on account of the absence of ankylosis, and the good result obtained with simple bandaging. It may be compared in many points with the anatomical specimens shown. The simple line of treatment carried out was suggested largely by the functionally good result evident in Dr. Cryer's specimen. In the literature I find that Roy[4] reports a case treated very similarly to this with equally good results. In no case is absolute fixation of the lower to the upper jaw by means of interdental splints advisable, owing to the proximity of the fracture to the joint with consequent danger of ankylosis. Moderate movement should be permitted in all cases. Where there is extreme displacement of the upper fragment owing to excessive violence, or ankylosis seems unavoidable, excision of the condyle is probably advisable, followed by arthroplasty.

[4] Roy, M.: L'Odontologie, 1913, xlix, 481.

From a study of the skull in which the deformity is so well shown, Cryer suggests that by an anteroposterior X-ray view the horizontal position of the upper fragment should be readily seen, thus confirming the diagnosis of fracture of the condyloid process. Great care must be observed to have the patient's head in exactly the right position in taking the X-ray picture, or the condyle will be overshadowed by the dense bone at the base of the skull. This unfortunately happened in my case. The anteroposterior view taken in every suspected case of fracture of the condyloid process will frequently be of assistance in establishing the diagnosis. By making several plates at slightly different angles it should be possible to show the displaced condyle.

The differential diagnosis of fracture of the neck of the condyle from luxation without fracture should present no difficulty. In fracture there is usually crepitus, the jaws can be closed, while the chin is deflected toward the injured side. In dislocation, the jaws are held open, the chin is deflected away from the injured side, and the condyle makes a distinct prominence well in front of its normal position, though this may be masked by the amount of traumatic swelling present.

Dr. John B. Roberts said that last summer he saw a lady who said she had recovered from a fracture on the left side of the face. She said she had slipped and struck that portion of her head against the corner of a table, and was told that there was a fracture of the lower jaw near the joint. She had looked upon it as a mere contusion. She then went, at the suggestion of her physician, to have an X-ray picture taken, which proved that a fracture of the condyle existed, evidently from direct injury. In the case reported by Dr. Ivy the man apparently received his by indirect injury, as the kick of the horse was received on the opposite side of the chin.

Dr. J. B. Carnett said that he had recently seen a case of the fracture described by Dr. Ivy in a man of advanced years, who had fallen from a second floor window. He was unconscious—at the point of death for many weeks—and the fracture did not receive any treatment. Some months later he sought advice because of lack of alignment of his teeth. He had a depression at the area normally occupied by the head of the lower jaw and it was obvious he had sustained a fracture of some variety. Dr. H. K. Pancoast made a very excellent X-ray picture of his lesion. The skiagraph shows a not uncommon type of deformity in which a fracture occurs through the neck, the head rolls inward, and the bone reunites in that position.

PAINFUL SUBCUTANEOUS TUBERCLE

By H. R. Owen, M.D.
of Philadelphia

A painful subcutaneous tubercle is literally what the name denotes. Were the name changed to painful subcutaneous neurofibroma, not only the chief symptoms but also the pathology would be told. These tumors have been described by A. Petit, Cheselden, Camper, Paget and others. Mr. William Wood [1] in 1812 described them, and gave to them the name they have since borne. The subject is discussed in a few of our modern surgeries and in few pathologies. The older surgeons treated the subject to greater length. Good descriptions may be found in Agnew's Surgery and Gross's Surgery. Of the modern surgeries, DaCosta, Treves, and Rose and Carliss [26] relate the occurrences of these tumors. Whereas painful subcutaneous tubercles are not common, on the other hand they cannot be called rare. When met with, they are not difficult of diagnosis. The seat of the growth of these little tumors is in the subcutaneous areolar and adipose tissue: they are usually found on the extremities, more often on the lower extremities than on the upper. Gross [2] is the only writer whose experience led him to believe that the upper extremity was the more usual location for their growth. He found they occurred more frequently on the shoulder and arm. In one case, which I had the opportunity of seeing with Dr. DaCosta last winter, the tumor was in the subcutaneous tissue of the chest. This specimen was afterward shown before the Academy of Surgery. Brodie [3] reported cases in which the tumor occurred upon the face. Robert W. Smith [4] reported two cases occurring on the fingers, and Sir James Paget [5] removed such a tumor from a thumb. Whereas the painful tubercles usually lie just beneath the skin, they are seldom attached thereto. A painful tubercle has a well-defined capsule which is usually loosely connected with the surrounding tissues. The overlying skin is not usually discolored, but, in the exceptional case when the tumor is attached to the skin, the skin is thin, polished and the superficial blood-vessels are tortuous and enlarged. This, as stated, however, is exceptional, as the tumor is usually freely movable, and the palpating fingers can move the tumor around under the skin within a radius of one or even several inches. In a case in which the tumor

lay in the subcutaneous tissues over the patella, it could be moved over the entire patella.

Such tumors are found in women far more frequently than in men. Neuromata, with which painful subcutaneous tubercles are often confused, are found more often in men. Paget [6] gives the following table of statistics: in 26 cases of neuroma, 19 were in men and 7 in women; whereas, in 28 cases of painful subcutaneous tubercle, 23 were in women and 5 in men. It usually occurs singly, although W. Wood [7] reported a case in which three of these tumors were removed from the tissues overlying the glutæus maximus muscle.

It is either round or oval in shape, and usually about the size of a pea, though it may be somewhat larger. In consistency, it is very firm and it feels elastic when rolled between the fingers. According to Carruthers,[8] the tumor occasionally has a central cavity filled with fluid. In only one case reported, which will be mentioned later, has there been any tendency to ulcerate or break down.

Of the *symptoms,* the most characteristic is the pain which is radiating and neuralgic in type. This pain is greatly increased when the tumor is palpated, as the tumor itself is exquisitely tender; in fact, the tenderness is so marked that the patient is usually very apprehensive about the handling of the region. The patient from whom I removed such a tubercle from above the patella was not only afraid to kneel down because of pain, but, for several weeks prior to the operation, had been so apprehensive of pain, that she walked with her knee stiff, fearing to bend the joint. The tubercle when removed was round, very firm and no larger than a pea.

The pain is not usually continuous, but occurs in paroxysms. These paroxysms may last for many hours if the tumor has received a blow. If such a tumor on an arm or leg receive a blow, the extremity may be thrown into a clonic convulsion. The patient may fall because of pain, and not infrequently faints if the tumor is struck. The pain is often exaggerated during mental emotion, especially during the menstrual period. In the exceptional case, if the tumor has received a blow, the surrounding parts may become œdematous, simulating angioneurotic œdema.

The *structure* of these tumors appears still to be somewhat in doubt; they are now usually classified under "neurofibroma."

Velpeau [9] believed them to be neuromata of subcutaneous nerves. This theory is held by others. In the *American Text-book of Surgery,*[10] we find the statement, "The painful subcutaneous tubercle is connected with a sensory filament of a

cutaneous nerve" and "is usually made up of fibrous tissue." Keen [11] classifies them under neuromata and states, "when one grows on a terminal twig of a cutaneous nerve, it gives rise to so much pain, which is often like an electric shock when touched, that it is in consequence "a painful subcutaneous tubercle." Gross [12] also classified them under neuromata, stating that "a few fine examples of neuroma in the form of the painful subcutaneous tubercle of the hand are on record." Treves [13] and DaCosta [14] classify such tumors under fibromata. DaCosta states that "nerve fibrillæ are now known to exist in these tubercles, a fact which was long denied." McFarland [15] says of the painful subcutaneous tubercle, "it consists of fibro-connective tissue, in which some claim to have found nerve filaments."

In two cases, in which I had the specimens examined, nerve filaments were found in each, the pathological report being "neurofibroma." Some surgeons, however, have not taken the same attitude regarding the pathology.

Agnew,[16] speaking of such a tumor, said, "though it contains no demonstrative nerve elements, being composed only of fat and connective tissue, it undoubtedly has some relation to adjacent nerves, or, it may be that some of the supposed connective-tissue fibres are amyelinic nerve fibres."

Dupuytren [17] stated that he dissected several such tumors with minute care, and never saw even the smallest nervous filaments adhering to their surfaces.

Paget [18] was of the same opinion. He was never able to find existing nerve-fibres in the tumor. He was disposed to think that most of them are only connected with nerves, as ordinary innocent tumors are, that receive a few fibres in their substance.

Because of the fact that the pain of these tumors is so out of proportion to their size, and because he was unable to find nerve structures within the tumor, he believed that the excruciating pain should be assigned to a "functional rather than to an organic disorder of the nerves; to a disorder commencing in the nerves of the part which is the focus of the pain, but transmitted from them to others, which, in the nervous centres, are connected with them."

It cannot be possible that the pain is due purely to altered nerve fibres, as even tumors within nerves are not always exquisitely painful, and, as pointed out by Smith,[19] there is often little or no pain in cases of tumors which have existed in the trunks of nerves.

Stengel [20] classifies tubercle dolorosa under myomata, stating that "myomata of the skin occur in younger patients, even in childhood, and are generally multiple, and often painful." I believe, however, that these must be another variety of painful tubercles. Such tumors have always been described as being benign, but Warren [21] describes one malignant form of these tubercles in which the lymphatics may become involved, but he cites no cases. I was able to find only one case reported wherein the tumor became malignant. This was a case of painful

subcutaneous tubercle reported by Dupuytren,[22] in which the tubercle acquired a schirrous nature and underwent cancerous softening.

The painful subcutaneous tumor may be diagnosed from a neuroma, by the fact that the former is usually single, whereas the latter is more often multiple; the former occurs more frequently in women, the latter in men; the former grow slowly, some attain full growth and remain stationary, and never attain any considerable size; whereas the latter grow consistently and have no limit to their size.

The treatment of the painful subcutaneous tubercle consists in excision. The authors of the *American Text-book of Surgery*,[23] in speaking of treatment, say: "the treatment is excision of the tumor together with the portion of nerve twig in which it grows." It is not always possible, however, to find such a twig. Gross,[24] in summing up the treatment, says there should be "free excision, including a portion of the surrounding healthy integument."

The tubercle can be removed under local anæsthesia. In those which I have removed, however, I used nitrous oxide gas, because of the fact that the tubercles usually occur in the nervous type of women, and because the tubercles were so small that I feared they would be hard to find after infiltrating with a local anæsthetic. Because of the fact that the tubercle is often so small and movable, it is well to fix it with a needle before making the incision so that it may be readily found. Cases have been reported in which the tubercle recurred after removal. Sir Astley Cooper [25] reported such a case in which he removed two painful subcutaneous tubercles from a woman's leg at an interval of a year. Similar cases have been reported by Paget and Tait.

REFERENCES

[1] Wood: Edinburgh Med. and Surg. Jour., vol. viii, 1812.
[2] Gross: System of Surgery, vol. i, p. 235, and vol. ii, p. 1017.
[3] Brodie: Med. Gazette, vol. xxi, p. 926.
[4] Smith: Treatise on Neuroma.
[5] Paget: Lectures on Surgical Pathology, p. 487.
[6] Paget: *Ibid.*
[7] Wood: *Ibid.*
[8] Carruthers: Edinburgh Med. and Surg. Jour., vol. xxxiii.
[9] Médecine Opératoire, vol. iii, p. 101.
[10] American Text-Book of Surgery, p. 412.
[11] Keen: Keen's Surgery, vol. i, p. 761.
[12] Gross: System of Surgery, vol. i, p. 1017.
[13] Treves' Surgery, vol. i, p. 458.
[14] DaCosta: Modern Surgery, 1914, p. 355.
[15] McFarland: Text-Book on Pathology, p. 234.

[16] Agnew's Surgery, vol. iii, p. 624.
[17] Dupuytren: Leçons Orales, vol. i.
[18] Paget: *Ibid.*
[19] Smith: *Ibid.*
[20] Stengel: Text-Book on Pathology, 1906, p. 185.
[21] Warren: On Tumors, p. 60.
[22] Dupuytren: *Ibid.*, p. 542.
[23] American Text-Book of Surgery, p. 414.
[24] Gross: *Ibid.*
[25] Illus. of Disease of Breast, p. 84.
[26] Rose and Carliss: 1914, p. 213.

Dr. P. G. Skillern, Jr. said that he attended a case at the University Hospital Dispensary during the summer which was very much akin to the one described by Dr. Owen. The patient was a male, aged twenty-nine years, who for two years had had a sensitive spot at the upper outer portion of the left leg, and he had pain in the leg at night. He had had a skiagram taken and was said to have an osteoperiostitis. An X-ray taken under Dr. Skillern's direction was negative. On the upper outer portion of the left leg was a minute mole the size of a millet seed. Touched by the tip of an ordinary probe this little tumor was the seat of excruciating pain. The tumor was removed under novocaine suprarenin infiltration. A clinical diagnosis was made of neurofibroma. Histologically, the condition was a small encapsulated growth, a hæmangioma, beneath the skin. Last summer he saw a case with an exquisitely tender subcutaneous tubercle over the internal condyle of the right femur, which might have been diagnosed neurofibroma, but which cleared up under antigout treatment. The diagnosis of these subcutaneous gouty nodules must always be borne in mind in surgical cases.

Dr. Owen, in closing, said that the case which prompted him to write the paper was that of a young lady, twenty-one years of age, who had a small tumor over the patella for a number of months. It had been treated for some time by ointments. Finally the knee became so painful that a splint was applied. On one occasion the tumor had been diagnosed a ganglion and had been struck by a book with the hopes of rupturing it, whereupon the young lady fainted. The leg was thrown into a clonic convulsion by this blow. When she came under my observation she was walking with a stiff leg. She was so apprehensive of pain she would not bend the knee. Since the removal of the tumor she has had no further trouble.

NEPHROLITHIASIS IN CHILDHOOD

Dr. J. S. Rodman presented a boy of twelve years upon whom he had operated at different times for bilateral kidney stone. The boy has always been undersized but otherwise, except for whooping-cough, has been healthy, until four years ago, at which time he had a severe attack of cerebrospinal meningitis. He was confined to bed for nine weeks and most of the time was delirious. Since then more or less severe headaches have been rather frequent. During the summer of 1910 he passed bloody urine for the first time. The hæmaturia was not accompanied by any abdominal pain, and, in fact, the latter has never been present. The urine returned to normal after a course of medical treatment, only to become bloody again after a lapse of several months. He has never passed gravel and his general health has remained good despite the loss of considerable blood in the urine, which has always, during the past month, been dark red in color. There has been some sediment of late in the urine.

Physical examination showed an apparently healthy boy somewhat small for his age. A careful detailed examination showed nothing abnormal. Neither kidney was palpable, nor was there marked tenderness over either kidney area.

Examination of the urine showed specific gravity 1020, color light red; trace of albumen; no sugar; no casts; moderate number of urates; macroscopic and microscopic blood.

The X-ray report showed stones in both kidneys—one large stone in upper pole of right kidney and one large stone and two smaller ones in the left kidney. The large stone in the left kidney was in the pelvis, the other two in the other pole. It was decided to remove the stones at different times, so that, on February 10, 1911, the right kidney was attacked under ether anæsthesia through the usual oblique incision. On exposing the kidney the stone was readily felt and removed, through an incision into the cortex. Rather free bleeding was encountered, but was easily controlled by catgut sutures. The stone was hard and about the size of an almond. The wound was closed with gauze drainage.

Following this operation the boy's recovery was uneventful, after rallying from rather marked operative shock. The gauze was removed at the end of forty-eight hours and the wound stopped draining urine one week after operation. The child was discharged three weeks after operation in satisfactory condition, the wound having entirely

healed. On several occasions after the operation there was blood in the urine, although it had disappeared at the time of leaving the hospital.

On November 12, 1911, he was readmitted, his health having been good in the meanwhile. His urine had not contained blood in the interim. A second X-ray examination showed, as before, one large and two smaller stones in the left kidney. On November 16 the left kidney was exposed and the larger stone in the pelvis immediately felt. The kidney cortex was incised and a smaller calculus in the lower pole, about the size of a large pea, and a soft stone resembling a blood clot felt and removed. The larger stone in the pelvis was also removed and was about the size of a small pigeon egg. The boy lost somewhat more blood during this operation than the first, but again the bleeding stopped upon suturing the kidney, wound closed, as before, with gauze drainage. His convalescence from this operation was exceedingly stormy. Shock was profound, and for forty-eight hours suppression of urine made us fear that he would die. Cupping, external heat, salt solution and hot packs finally started elimination, but for one week his condition remained desperate. After this convalescence became established. The gauze was removed at the end of forty-eight hours, as before. He was discharged December 23, 1911, five weeks after operation in excellent condition. The wound had healed, having ceased draining urine ten days after operation. The urine report at the time of his second discharge from the hospital showed pale amber, flocculent sediment; specific gravity 1018; reaction acid; small ring of albumen; no sugar; no casts; few leucocytes; few pus cells; few epithelial cells, and a moderate number of urates. His health has been excellent since the last operation, he has grown rapidly, and, strangely enough, does not now suffer from headaches. At no time since the second operation has there been blood in the urine.

Dr. Rodman remarked that the subject of kidney stones in children had received but scant attention in comparison to the wealth of literature on the same subject in adults. Several important articles have appeared, however, during the past ten years, which deal largely with the etiology and pathology of stones. Despite the fact that most of the text-books of surgery dismiss the subject with the mere statement that renal calculus in children is common, the more recent literature would seem to indicate just the opposite. Nephrolithiasis in children is rare, but bladder-stones, with which we are not concerned in this report, are common. Age, sex, and race have some influence.

Thus, in Rafin's series of 39 cases, 2 of his own and 37 collected from literature, 5 were from one to five years, 18 from five to ten years, and 12 from ten to fifteen years. There were 24 boys and 11 girls in this series. Again, in the Mousseaux series of 77 cases there were 51 boys and 26 girls, while in Neupaner's series of 100 cases only 5 were girls.

It would seem that stone is more common in Hungary, Upper Silesia, England, Turkey, the country of Altenberg, Germany, and the town of Weida, near Jena. As to the actual etiology, much diversity of opinion is found. Ebstein believes that certain salts excreted from the blood and retained by the kidneys cause damage to the renal cells, thus forming the necessary organic material for the formation of stones. Joseph, in a report of 42 cases in infants with necropsy, found an albuminous material filling the tubules, and believes that this substance is the foundation of stone. He attributes its formation to altered metabolism. Klemperer and Brugsch speak of a renal stone diathesis which is brought about by a change in the metabolism, probably an excess of stone-forming salts in the blood stream. This diathesis expresses itself through diseases of the stomach and central nervous system. Rosenbach believes that the damage to the renal cells is not primary, as Ebstein claims, but rather secondary, due to a blocking of the urinary stream. In support of this theory Muschka states that blocking of the urinary stream produces swelling of the tubule walls and thus causes stone deposition. Kubitz believes that stones are composed chiefly of uric acid and its salts. Ebert, however, considers that uric acid infarcts are so common in infancy as to be almost physiologic. He considers that endemic conditions play an important rôle in the formation of sediments in the kidney parenchyma and pelvis. A gouty heredity is frequently found. For instance, Gibbons reports six cases of kidney stone in children, all of whom had had gouty parentage. Calcium contents of the water and gastro-intestinal disturbances may also play a part.

The pathology of renal calculus depends entirely upon whether the stones are primary or secondary. By a primary stone we mean one which forms independent of infection and is usually round or oval, smooth, without processes into the calyces, hard, and on section their structure is more uniform and artistic. The chief point of difference is that they have a lower percentage of calcium. Such a stone causes little damage to the kidney substance. The pathological changes that are found are due to congestion, and consist in thickening

of the capsule, exudation into the glomeruli, cellular infiltrations, and cell degenerations. On the contrary, secondary stones, being always the product of infection, are almost invariably accompanied by grave renal destruction. According to Ebert, the most common kidney stones are composed of sodium urate. In Mousseaux's series there were, of 77 cases, 55 urate stones, 12 mixed urate and oxalate, 1 pure oxalate, and 9 phosphatic. He states that cystin and xanthin stones are almost never found in children. In the series collected by Rafin, where the chemical composition was mentioned, there were: uric acid 5; oxalic acid or urate 4; phosphate of lime 4; carbonate of lime and phosphates 4; urates and phosphates 2; urates and oxalates 2.

In the symptomatology of kidney stones as occurring in children one is struck by the infrequency with which renal colic is mentioned. In fact, pain does not seem to be a prominent factor. It was entirely absent in my case, and writers on the subject have mentioned its infrequency. Hæmaturia is an important symptom, as is sediment in the urine.

Certainly the diagnosis rests almost entirely upon the X-ray. Here it must be remembered that not all varieties of stone are equally impermeable to the rays. The softer uric acid stones do not, for instance, throw as definite shadows as the harder varieties. The treatment, of course, is surgical, once the stone is formed and symptomatic. Renewed importance must be attached, however, to subsequent medical treatment, as surgery cannot cure the stone-forming diathesis. There is no doubt that the kidney possesses definite solvent properties, as is shown in the experimental work of Rosenbach on oxamide stones. These substances were placed in the kidneys of dogs, and when the organs were subsequently removed marked absorption had taken place. What is true of unilateral kidney stones is also true, in general, of bilateral calculus. In a series of 76 cases, 38 were bilateral, according to Legen. Kubitz collected several series of kidney stones, reported by different authors, occurring at all ages, and found that as an average 18.7 per cent. were bilateral. An ascending infection of the sound kidney following cystitis of course predisposes to secondary stone formation. In this way unilateral stone may become bilateral, since calculus is so frequently followed by cystitis. Other case reports, as those of Nash, Jaffrey, and Parkinson, remark upon the relative infrequency of kidney stones in children. Out of 96 operations, Morris states that none was under ten years. R. C. Dunn states that in 283 cases there was only one under ten years.

BIBLIOGRAPHY

Rafin: Annal des Malades Genito Urin., vol. i, No. vi, March 2, 1911.
Kubitz: Doppelsitige Nephroliathiasis.
Rosenbach: Deut. Zeit. fur Chirur., September, 1911.
Ebert: Med. Klinik, No. x, 1912.
Treplin: Archiv fur klin Chirur., 1904.
Kraus: Deut. Medizinische Woche., 1907.
Eisendrath: J. A. M. A., June 26, 1909.
Joseph: Virchow's Archiv, 1911, 205, xxiv.
Mandhle: Lancet, London, 1906, i, 1961.
Jaffrey: Report of the Society for Study of Diseases of Children, vol. vi, 1906.

APPENDICULAR OBLITERATION

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Much confusion exists in the minds of surgeons as to the significance of the term chronic appendicitis. As it is usually understood it refers either to a state of persistent low grade inflammation involving one or more coats of the appendix, or to recurring attacks separated by intervals during which it may be more or less free from the process or products of inflammation.

As the term is used by the pathologist it may refer not only to the above conditions but also to the results of previous inflammation of the appendix, as evidenced long after the infective process has passed by thickenings, fibrosis, cicatrices, strictures, kinks, and by destruction, absorption and replacement of various portions of its coats, particularly the mucosa. In the former instance the process is still active, though it may be sluggish; in the latter condition it is inactive except as its results may cause disordered conditions. It is the difference between a pathological process and a terminal pathological state. A good parallel may be seen in the chronic endocarditis which, still harboring microörganisms, continues slowly to attack the valves of the heart, as compared with the *so-called* chronic endocarditis which has become sterile and quiescent but acts through the defects and distortions of the leaflets which have been created. Active chronic disease of the appendix betrays itself under the microscope by œdema, hyperæmia, or by the cellular infiltrations which are the hallmarks of chronic infective processes. At a later time the evidences of an active process may be entirely lacking and in their stead we find only the end results above mentioned. It would lead to more accurate thinking and analysis of the true conditions if we were to speak of the former group as chronic active appendicitis and drop the term appendicitis entirely as descriptive of the latter condition, calling it instead appendicular sclerosis or obliteration, as the case may be. We would then be brought forcibly to face with the fact that not all chronic active appendicitis is productive of symptoms, or better perhaps, recognizable symptoms. In a series of 5500 appendices removed by Dr. John B. Deaver, 500 were removed in the course of a laparotomy for other conditions. Of

these, 112 (32.4 per cent.) were found normal and 388 (77.6 per cent.) presented well marked evidence of active or already established inflammatory changes. Of these 388 there were 71 (14.2 per cent.) which had undergone complete obliteration. It is a *reductio ad absurdum* to maintain that more than three-fourths of the entire population have been subject to appendicitis as we know the disease. We must therefore assume that chronic infective processes may go on in the appendix without producing diagnostic symptoms, or that the appendix normally undergoes certain retrogressive processes in the nature of atrophic fibrosis and obliteration. The latter view has been strongly championed by Ribbert. The argument in favor of physiologic involution of the appendix rests chiefly on the fact that the incidence of obliterative processes increases directly as the age, reaching as high as 50 per cent. in the seventh decade of life. When we reflect, however, that an appendix once obliterated is always obliterated the argument loses much of its force, since it is obvious that from whatever cause obliteration proceeds the percentage of frequency must rise with increasing years, just as in the case of gall-stones, which nobody considers a physiologic process for that reason. It is entirely probable that the process is favored by the general atrophy and sclerosis associated with increasing age, but to assume that it is an example of isolated old age in a particular organ, or, what Gowers speaks of as abiotrophy, is no longer tenable. Against this view are (1) the early age at which the process may begin. Obliteration, according to McCarty, may begin as early as the fifth and be complete at the tenth year of life. In the second decade from 3 to 17 per cent. show partial to complete obliteration. This is the period of active growth rather than of degenerative processes. (2) In an operative series the incidence of obliterated appendices does not increase directly with the age, but follows closely the curve of inflammatory diseases of the appendix. Thus in 100 consecutive cases the age incidence was as follows:

First decade	0	Fifth decade	18
Second decade	10	Sixth decade	11
Third decade	31	Seventh decade	3
Fourth decade	27		

The greatest number of cases fell between 20 and 30 years, corresponding to the period most susceptible to recognized appendictis.

(3) Clinical evidence points clearly to the importance of previous appendiceal inflammation. In 52 consecutive cases operated upon with a diagnosis of chronic appendicitis, 30 gave a history of previous sharp

attacks and 17 had had mild local symptoms. In 48 cases in which the appendix was removed incidentally, 5 gave a history of sharp, definite attacks in the past, 9 of indefinite probable attacks, and 6 complained of chronic indigestion. The history of one case is particularly significant. A man, aged twenty-three, was admitted to the German Hospital with a diagnosis of obstruction of the bowels. Nine months previously he had had a severe attack of acute appendicitis. At operation there were found peri-appendicular adhesions, beneath one of which a knuckle of small intestine had been caught and strangulated. The appendix itself was completely obliterated and inactive.

(4) Operative findings usually suggest previous inflammatory processes. It is not common to find an obliterated appendix swinging freely on a normal meso-appendix. Usually the mesentery is contracted, kinked, or absent. The appendix is frequently subcæcal, paracolic, or bound beneath the terminal mesentery. Often it is subserous. Peri-appendicular adhesions definitely inflammatory in origin were present in 25 per cent. of this series. The attempt of Lane and his followers to attribute most of the appendicular scleroses and obliterations to the consequences of ptosis seems forced in view of the numerous instances of omental and pelvic adhesions which do not admit of any such explanation. That many obliterated appendices do not present peri-appendicular adhesions seems to be due to two facts, namely, the facility with which simple plastic adhesions are later spontaneously released by natural processes leaving no trace behind, and also to the nature of the process of obliteration, which takes two chief forms, and leads us to a consideration of the fifth and pathological reason for assigning infection as the cause of the process.

(5) Obliteration occurs as the result of certain types of acute appendicitis or in consequence of chronic infection of a persistent character with or without exacerbations. It is not exceedingly uncommon to find appendices the mucosa of which has become completely gangrenous without gangrene of the outer coats. This is a consequence of a severe mucosal infection usually aided by increased intra-appendiceal pressure due to proximal blockage of the lumen. If now the obstruction ceases to operate as by the discharge of a concretion into the cæcum or by the softening of a strictured segment, drainage will take place into the cæcum, the mucosa will slough away leaving granulating surfaces which will cohere before epithelialization can take place by continuity from the cæcum. Or, if a perforation occurs at one point and the patient be fortunate enough to recover without removal of his appendix, the end result will be a fibromuscular vestige devoid

of lumen. In these types of appendicitis permanent peri-appendicular adhesions will often be formed. The case above reported, of rapid obliteration following acute appendicitis with obliteration as a sequel, probably belonged to this class. More frequent than this is the sclerosis and obliteration which results from chronic catarrhal and interstitial processes. I have examined many appendices removed incidentally in the course of abdominal operations for conditions foreign to the appendix in which unmistakable evidences of chronic active inflammation of the organ were present. This occurs not infrequently in the entire absence of any of the recognized symptoms or signs of appendicitis. That this is true is also shown by the large number of cases which present evidences of antecedent inflammation without a history suggestive in any way of appendicitis. All the steps of obliteration can be traced. Cellular infiltration occurs in the outer coats and excites the deposit of fibrous tissue which impedes the blood and lymphatic circulation, renders the organ less elastic, and thus subjects the mucosa to increasing pressure during the periods of œdema and congestion consequent upon the more or less severe exacerbations of infection. In addition to this there is a gradual contraction of the newly-formed diffuse cicatricial tissue. Under these influences the mucosa becomes thin, the glands gradually disappear, the mucosal stroma, and often the lymphoid tissue, undergoes pressure atrophy and disappears. The encroaching fibrous tissue joins across the gap now microscopically minute and appendicular obliteration is complete. Such a process may go on without involving the serosa of the appendix. No adhesions are excited and so slow and inconspicuous may be the whole process that symptoms of any moment may not be called forth, and if they do exist they are most often misinterpreted. Thus, in the 52 cases operated upon with a diagnosis of chronic appendicitis 8 had had a long standing history of indigestion prior to the development of acute attacks and 7 had mild local symptoms preceding a definite seizure which made the diagnosis.

The cause of the symptoms in appendicular obliteration is not only an interesting but important consideration. In what manner does an appendix cause symptoms after it has been reduced to a thin fibromuscular cord devoid of any chronic inflammatory process? That simple removal of such an appendix does abolish symptoms in the majority of cases there can be no question. On the other hand, it is a well-known fact that appendectomy, particularly in this type of case, does not always cure or relieve the symptoms. In 100 cases of chronic appendicitis followed by Stanton with reference to end result, 64 were

cured and 36 were unsatisfactory, in that relief was not obtained or other lesions were found to have been the cause of the symptoms. Graham and Guthrie reported 85 per cent. of cures or improvement, 10 per cent. followed by return of symptoms, and 5 per cent. unimproved. Scudder and Goodall attempted to follow 3000 appendectomies done in the Massachusetts General Hospital, but were able to trace only 640. Of these 94.6 per cent. were cured, but the returns fell so far short of the entire number that this higher percentage is not convincing.

The reasons for failure are various. It is granted that a certain small percentage represents mistakes in diagnosis, the lesion being in no way connected with the appendix or the adjacent bowel. The greatest interest, however, centres in other conditions of the ileocæcum and ascending colon about which it is being attempted to build up pathological and clinical entities. The most important of these are cæcum mobile, pericolic membranes and Lane's ileal kink. The discussion of these conditions is not the purpose of this paper, but I wish merely to point out that it is quite unnecessary to refer all failures of appendectomy to the existence of special conditions such as those mentioned.

There are three types of symptoms referable to the obliterated appendix: (1) Those which are referred to other regions of the abdomen, most commonly the epigastrium; (2) local symptoms; (3) general symptoms consequent upon disturbance of function of the bowel.

In this series 4 cases presented epigastric symptoms alone. In 6 others epigastric symptoms were combined with local symptoms. In 2 cases the symptoms were such as to cause suspicion of duodenal ulcer, and in 4 gall-bladder disease was suspected. The occurrence of epigastric symptoms has been plausibly explained by the assumption of reflex nervous influences set up by irritation of the nerve supply of the appendix. In such appendices the ganglion cells of the plexuses of Meissner and Auerbach can easily be seen in a degenerated state. The mechanism exists, therefore, for such action and there seems no reason to doubt that it occurs. Removal of the appendix and with it the irritated ganglionic centres and nerve fibrils should relieve reflex symptoms. Graham and Guthrie's excellent statistics as to cure, above quoted, related particularly to this "dyspeptic" group of chronic appendicitis, and Deaver, Moynihan and many others have placed this type of appendiceal disease on a firm footing as regards its existence and cure.

What is not so well understood, in my opinion, is the fact that local symptoms of appendicular disease do not spring directly from the

appendix itself. The appendix in common with other portions of the alimentary tube has no perception for pain or power of localization. Its sympathetic nerve supply does not possess this ability and it is doubtful if any spinal fibres reach the appendix. Local symptoms are called forth only by inflammation propagated to other structures possessing sensibility or through the medium of traction upon structures which have spinal innervation, normally the meso-appendix, abnormally acquired adhesions.

In these chronic sclerotic or obliterated appendices, therefore, it is not the inert appendix that is responsible for localizing symptoms, but its shortened and fibrous meso-appendix, the acquired adhesions to adjacent mesentery or parietes, or adhesions of the cæcum, colon or small intestine, the consequences of peritoneal infection and, most important, retroperitoneal lymphangitis, which disturb the motility of the bowel and under conditions of distention or activity or during peristalsis excite pain. The appendix in many cases acts as a guy rope attached to the tip of the cæcum preventing foreshortening and emptying of the cæcum by the longitudinal muscles.

Disturbance of function of the ileocæcum manifests itself by a further train of symptoms, chief of which is constipation. It is probable that in some cases chronic toxic manifestations are a result. Just what proportion of the "grisly troop" enumerated by Lane and Metchnikoff are due to this cause remains to be determined.

Appendectomy releases the cæcum from the tether of an adherent appendix and the contracted meso-appendix. At times other symptom-producing adhesions are released as well. In other cases through ignorance of the exact organic cause of symptoms or because of operative difficulties the essential factors are left behind when the appendix has been removed. It is asking too much to expect that simple appendectomy will relieve all symptoms due not only to the appendix but also to complications secondary to the appendicular disease but no longer dependent upon it. Just what constitutes a normal arrangement of the ileo-cæco-colic region, how much divergence may occur without symptoms, what type and situation of adhesions are most troublesome, and how to remedy them, are questions that do not at present permit an answer, but it is clear that the attachments of the bowel in the ileo-cæcal region have a most important bearing upon function and symptoms and that it is the surgeon's duty at present to observe and digest before generalizing.

In this series but one case of associated Lane's kink and Jackson's membrane was observed, and in this instance there were omental ad-

hesions to the parietal peritoneum in the right iliac fossa. Whether the disease of the appendix had been responsible in this instance for the other abnormalities it is impossible to say but the evidence of former adhesive inflammation in this quarter is at least suggestive.

Constipation, at times amounting to intestinal stasis, was the rule in this series. In only 5 were the bowels said to be regular. Two were inclined to diarrhœa. Twenty-five, or about half, were troubled by constipation and in 20 no note was made of the condition of the bowels. The appetite in general was good. Nausea and vomiting were rare, except in connection with a history of definite seizure of pain in previous attacks. Indigestion was admitted in 26, denied in 3, not mentioned in 23. Some form of pain or distress was complained of in every case in which a pre-operative diagnosis of chronic appendicitis was made. It was variously described as dull, aching, dragging, sticking, sharp, crampy and soreness. In 27 cases it was in the right iliac fossa alone, in 5 cases in the epigastrium alone, in 6 cases in both, in 2 it was general, in 3 there were radiations to the right loin and thigh, and in 9 it was aggravated by exercise or activity. The symptoms dated back according to the history from 4 days to 25 years, with an average of more than 5 years. Only 7 gave the duration in months, and in 33 it had been a matter of years. Females predominated, 31 to 21. The leucocytes averaged 8620 per cubic millimetre with a minimum of 4600 and a maximum of 14,500. The few cases which showed some fever, leucocytosis and evidence of inflammatory exacerbation were not instances of complete obliteration. When the obliterative process has reached the cæcal junction there is no longer opportunity for bacterial invasion, a condition dubbed by Morris, protective appendicitis.

The 46 cases of incidental removal of obliterated appendices were distributed among 11 different abdominal diseases, to enumerate which would serve no purpose. It is a curious fact, however probably a mere coincidence, that 7 were removed during operations for extra-uterine pregnancy. During this same period the total number of cases operated on for this condition was 19, so that one in three of the cases of extra-uterine pregnancy presented obliterated appendices. As all these cases gave evidence of chronic or subacute tubal disease it is not beyond the bounds of possibility that the previous appendicitis had been the true starting point of the subsequent extra-uterine pregnancy through the well-known tendency of infective processes from the appendix to communicate disease to the tubes, which in turn would predispose to tubal gestation.

For the privilege of analyzing 100 consecutive cases of appendicular obliteration operated upon by Dr. John B. Deaver I wish to thank him as well as to acknowledge that my opportunity for observing clinically the conditions to which I have directed attention in this paper are largely due to my association with him. In conclusion it should be recognized that:

(1) Appendicular sclerosis and its terminal stage, appendicular obliteration, differ pathologically and clinically from chronic active appendicitis.

(2) Three types of symptoms are to be considered: (*a*) reflex, due to irritation of the nervous mechanism of the appendix; (*b*) local, due to mesenteric and peritoneal contractions and inflammatory bands or adhesions affecting the appendix, cæcum, ileum or ascending colon; (*c*) consecutive symptoms, general and local, consequent upon disturbed function of the ileocæcal region.

(3) Simple appendectomy avails for reflex symptoms, but in local and consecutive symptoms only in so far as the operation permanently frees symptom-producing contractions, sclerosis or adhesions.

(4) The determination of these latter conditions and the appropriate treatment therefor awaits further observations and experience.

Dr. John B. Deaver said that he believed and could prove by bacteriological research, that the appendix is responsible for the majority of cases of cholecystitis. According to reports from the Laboratory of the German Hospital 25 per cent. of the cases of gall-bladder operations showed the colon bacillus.

The typhoid bacillus is next to the colon bacillus in causing infection of the gall-bladder, but that the colon bacillus predominates there is no question.

Dr. John H. Gibbon urged on behalf of the original title of this paper, "Obliterative Appendicitis," that it was the better title, because the paper shows distinctly that the obliteration of the appendix was probably of inflammatory origin. It is a term also that has been used right along and is descriptive of obliterative results of inflammatory change.

Dr. Pfeiffer, in closing, said, in explanation of the title "Appendicular Obliteration," that it was simply to call attention to the fact that the ending "itis" in "obliterative appendicitis" is misleading, unless it is thoroughly understood that the inflammation is past. One sees obliterated appendices of recent date in which there is still an active inflammatory process; but, in the vast majority of obliterated appendices, there is no more inflammation. The object is to call attention to the fact that there are no inflammatory processes present.

TYPHOID SPINE

WITH REPORT OF FOUR CASES

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of Philadelphia

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Over one hundred cases of typhoid spine have been reported since the publication of the first paper calling attention to this condition by Gibney in 1889. Gibney expressed the opinion that in typhoid spine there is "an acute inflammation of the periosteum and the fibrous structures which hold the spine together." The next important paper on this subject, a few years later, was by Osler, who, unfortunately, in reporting some of his own cases described the condition as a pure neurosis. The pathology of typhoid spine has been the subject of much theoretical discussion along the lines of the divergent views expressed by Gibney and Osler.

The only reported autopsy examination was not performed with sufficient detail to throw much light on the lesions present. The only complete post-mortem study of which I have any knowledge is that made by J. Torrance Rugh in a case some years after the disappearance of the acute symptoms.

The earlier cases of typhoid spine were observed before the days of the X-ray or before X-ray technic had developed sufficiently to demonstrate the spinal lesions. Even in many of the recently reported cases skiagrams were not taken. Thus far, less than 30 cases of typhoid spine have been reported in which X-ray pictures were taken and in some of these the skiagrams were negative. To this list I have added three personal cases in which the X-ray disclosed definite bone changes. Sufficient evidence has been accumulated to prove definitely that Gibney was correct in his original view that an inflammatory organic lesion does occur in these cases.

That a pure neurosis might possibly simulate, to a certain extent, the true inflammatory organic lesion of typhoid spine just as it might simulate any other organic lesion cannot be denied, but in view of our present knowledge of the subject such confusion should not occur. In other words, those cases which only simulate typhoid spine, whether because of a neurosis, a toxæmia, or any other cause, but which do not present

organic changes should henceforth be excluded from the list of true typhoid spine cases. The fact that the skiagram has been negative in a few cases does not in itself disprove the presence of an organic lesion; the bone changes may have been too slight to be demonstrable or the pictures were either faulty, or, when taken early in the course of the disease, were negative, when later ones might have shown bone changes, as in my third case.

The statistics on the reported cases of typhoid spine have been collected and analyzed by Cutler, Silver, Halpenny, Rogers, Gaudefroy, Elkin and Halpenny, and others. It has been found that fully 85 per cent. of the cases occur in males. The youngest patient was eight years and the oldest fifty-six years, but the majority were between twenty and thirty-five years.

Typhoid spine occurs as commonly in mild cases of typhoid fever as in severe ones. In the vast majority of instances the affection is located in the lumbar spine or in it and the immediately adjacent thoracic or sacral vertebræ, although it has been reported affecting only the thoracic or cervical vertebræ, or, as in a case reported to this Society by Dr. Elmer, involving only the sacro-iliac joint. Commonly only two adjacent vertebræ are involved, though, rarely, several may be.

Pathology.—That the affection is located so commonly in the lumbar spine is due to various factors. Fraenkel found typhoid bacilli more frequently in the vertebræ of the lumbar region than elsewhere, due probably to the relatively larger amount of bone marrow in them. The lumbar spine is also normally subjected to greater stress and strains than is the remainder of the spinal column. Silver has further suggested that, in addition to the greater amount of cancellous tissue offering low resistance to the typhoid bacilli, there is the possibility of direct infection from the adjacent lumbar lymph-nodes. Typhoid spine is almost never a fatal affection, hence post-mortem study of recent cases is wanting.

The clinical evidence points to the lesion being a spondylitis with periostitis, enchondritis and deposit of inflammatory exudate. The X-ray has demonstrated absorption of the intervertebral disc and slight destructive changes in the bodies of the vertebræ as the earlier changes; and later, bone proliferation from the periosteum and bone deposition along the lateral ligaments producing firm bony ankylosis of the approximated adjacent vertebral bodies.

The infrequency of suppuration in the vertebræ as compared to typhoid lesions in other bones has never been satisfactorily explained.

The cause of referred pains and rhythmical contractions is some-

what problematical. They may be due to neuritis from extension of the inflammation and this seems suggested by evidence of organic nerve lesions in some cases. Again they may result from meningitis. Positive Kernig's sign has been noted but only rarely. Lumbar puncture has shown the tension of the spinal fluid increased in a few instances and normal in others. Pressure on the spinal nerves or nerve roots by inflammatory exudate seems the most probable cause. Those cases in which there are alternations of the referred pains and rhythmic muscular spasms suggest that whatever irritation is present in those cases must be located at some point where the motor and sensory fibres are separated one from the other. This would imply an exudate exerting pressure on the anterior and posterior spinal nerve roots proximal to their passage through the intervertebral foramina. The rhythmic contractions being synchronous with the pulse, would indicate they were due to pressure which would alternately be increased and decreased as the blood was forced through the pressure area.

The onset of symptoms was usually gradual, but in many was abrupt and acute, occurring in a few cases during the febrile period, most often during convalescence, and quite frequently some weeks or months, in one case four years, after recovery from typhoid fever.

There seems no doubt that the typhoid bacillus is the cause of the lesion. The presence of typhoid bacilli in bone marrow, especially of the spine, in patients dying of typhoid fever has been shown by Quincke and by Fraenkel.

Various forms of slight trauma or exposure to wet and cold were given as the immediate cause for the onset in many cases. It is quite probable, however, that the spinal lesion was already present and that the trauma merely aggravated it or first called attention to its existence. This would seem to be the case in those patients in whom acute symptoms developed within a few hours after receipt of the trauma.

The symptoms of typhoid spine can be classified as (1) constitutional, (2) local or spinal, and (3) referred.

Constitutional Symptoms.—The patient's temperature in one case was normal, but in all others reported in which the temperature was given it was elevated, seldom reaching 103° or 104° F., but in one of my patients going to 106° F. in the first twelve hours. Fever usually subsided in a few weeks and persisted only two months in the longest instance recorded. The pulse-rate increased with the fever. The Widal tests, when taken, have been positive. Leucocyte counts have not been reported very frequently and have varied from 6000 to less than 18,000.

Great mental irritability has been noted in several instances, due probably to weakness from prolonged illness, present toxæmia, and harassing pain. A few patients threatened to commit suicide. This irritability in its various manifestations has been one of the main arguments in the past for regarding typhoid spine as a neurosis. As one writer has pointed out, if these patients with their painful organic lesions are treated as cases of neurosis, ordered out of bed, placed on exercises, etc., it might reasonably be expected that they would display "neurotic" symptoms.

Local or Spinal Symptoms.—Pain over the spine has been the most constant and prominent symptom, as well as usually the first to attract attention. The local pain, however, has sometimes been overshadowed by the greater intensity of the referred pains. Local pain over the site of the disease has usually been absent when the patient was at complete rest in bed, but was elicited by movements of the spine, whether by turning in bed or tests applied in making an examination. Downward push on the head or shoulders, jarring on the heels and efforts at bending or twisting the spine have aggravated this pain. The patients have protected themselves against exciting the pain, in the manner characteristic of cases of acute inflammatory lesions of the spine, by transferring weight through their arms and hands to their pelvis, thighs, bed, or chair; and picking articles from the floor by flexing the knees and hips rather than bending the spine. The pain has disappeared during the subsiding stage for days or weeks to recur on resumption of active exercise or labor.

Tenderness was elicited either over the spinous processes in the median line, or over the transverse processes in all cases. In some tenderness over the anterior surface of the bodies of the vertebræ could be elicited by deep abdominal palpation.

The spine in the affected region was stiff and spinal muscles were rigid in practically all cases. In some scoliosis was present, in others the normal lumbar lordosis was lost, and in a small percentage a vertebral prominence or definite kyphosis developed in the later stages. In but very few cases was there local swelling or redness. In only three or four cases did the disease result in suppuration requiring incision and drainage.

At the present day the X-ray in the later stages of the disease affords the best proof of the existence of a local spine lesion. In this connection I cannot commend too highly the method, which is not in general use, employed by Dr. Henry K. Pancoast of taking

lateral views of the spine to bring out details unobtainable by the usual anteroposterior exposures.

Referred Symptoms.—Aside from the purely local pain in the spine the great majority of typhoid patients experienced severe or even excruciating pains radiating in one or more directions, as around one or both sides of the lower chest or abdomen, down one or both lower extremities, and into the testis. The referred pains were usually intermittent in character and very often were most violent and persistent at night, requiring opiates to procure sleep. The referred pains might persist from a few minutes to several hours at a time and then cease and recur after minutes or hours. These pains were commonly brought on or aggravated by any movement involving a strain on the spine, as turning in bed, lifting a leg, coughing, sneezing, etc. In a few cases the hot-water bottle was efficacious in controlling the pains. Complete fixation of the spine by a body plaster cast, spinal brace or extension apparatus usually gave prompt and marked relief.

Quite frequently tenderness was present over the same areas as the pain radiations. Occasionally muscular rigidity of an intensity which varied on different days, or even at different hours of the same day, was encountered in those cases in which pain was referred to the abdomen.

A few cases of typhoid spine have exhibited a curious rhythmical alternating contraction and relaxation of the abdominal muscles on one or both sides. These contractions usually have been synchronous with the pulse beat, and in one reported case they could be abolished by compression of the upper abdominal aorta. The contractions have arisen spontaneously with the patient at complete rest in bed, or have been started up by movements affecting the spine. They would occur rhythmically for a few moments up to three or four hours, and cease only to recur later. The individual contractions have been mild at one time and violent at another, or might start mildly and become vigorous, giving rise to discomfort varying from slight annoyance to great distress, and leaving the muscles sore, as if violently over-exercised, after the contractions cease. The contractions have occurred at intervals during which the referred pains might be either present or absent. The contractions as well as referred pain might be present on one side of the abdomen at a certain stage of the disease and on the other side at another stage. Rhythmical contractions of abdominal muscles were present in two of my patients. In one reported case muscular twitching of the thigh was noted.

The patellar reflex was increased in the majority of instances in

which it is mentioned, was normal in a few, and rarely was diminished. Ankle-clonus was observed in several cases and Kernig's sign rarely. Hyperæsthesia or paræsthesia of areas on back, abdomen or lower extremities was noted in several cases and not found in others. Muscular atrophy sufficient to indicate nerve lesion occurred infrequently.

Diagnosis.—The diagnosis of typhoid spine usually should not be difficult. The existence or recent history of typhoid fever, the characteristic localized acute spinal symptoms, the suggestive referred symptoms, the constitutional disturbances, and later the X-ray findings afford an unmistakable picture in the typical cases. Difficulty as to the diagnosis, however, may arise under certain circumstances. Not all pains in the back of typhoid patients are due to typhoid spine. Doubt may arise as to whether or not early symptoms in a given case are due to the gradual onset of a typhoid spine or due to some of the more common but less serious forms of backache. Continued observation and study of the further course of the affection will soon disclose the correct answer to the question.

In cases of acute onset with predominance of the referred symptoms, the local symptoms in the spine itself may easily escape observation, unless the possibility of typhoid spine is kept in mind and these local signs are sought for. If the possibility of a spine lesion is not given proper consideration then various erroneous diagnoses may be made. The constitutional symptoms of fever, pulse-hurry and leucocytosis, plus the referred symptoms of pain, tenderness and rigidity of sudden onset present a fairly complete picture of any of the forms of intra-abdominal inflammation or suppuration.

The particular lesion which the typhoid spine will simulate under such circumstances is dependent on the abdominal region to which the symptoms of pain, tenderness and rigidity are referred. In such circumstances, however, it may be found that some special symptom of the disease under consideration is wanting, that the local signs are a little too diffuse or that there are other inconsistencies in the picture or course of the affection viewed as a whole. But even then the picture so closely simulates the conditions for which immediate operation is indicated that, unless the possibility of spinal lesion is considered, the patient is apt to be subjected to a needless laparotomy.

Again, the presence of mild spinal symptoms may be recognized and yet the constitutional disturbance plus the referred symptoms and their location be so very characteristic of an intra-abdominal lesion that two erroneous possibilities present themselves—either that a spinal and an abdominal lesion exist independently of one another or that an

abdominal suppuration occurred first and the spinal symptoms arose secondary to a toxæmia, metastasis or direct extension from a retroperitoneal infection. If the diagnosis is uncertain under such circumstances it will usually be wise for the surgeon to delay operation until reasonably certain of the situation. The X-ray cannot be depended upon when the early pictures are negative, as it may require weeks for bone changes to develop to the extent that they can be shown by skiagraphs.

Prognosis as to life seems entirely favorable as none of the patients died of the typhoid spine lesion. Suppuration to the extent of requiring evacuation has been very rare. It is possible that small foci of pus might form and be absorbed. Absorption of one intervertebral disc with osseous ankylosis of the two adjacent vertebræ may be expected. Occasionally changes of the same type have involved more than two vertebræ. Kyphosis may or may not develop, or, as pointed out by Silver, may be present and obscured by heavy overlying muscles. By proper support of the spine until ankylosis occurs kyphosis can be prevented. A relapse to the extent of return of pain and tenderness is not uncommon during the subsiding stage from too early resumption of activity, but, unlike inflammatory spinal affections, typhoid spine, once arrested, does not tend to recur. Symptoms disappear in a few weeks or months, as a rule, but in Brownlee's case they persisted for 21 months. The ultimate functional result is usually perfect. If only two vertebræ are ankylosed the adjacent joints apparently are able to compensate for the lost mobility.

Treatment.—The best form of treatment is mechanical. The spine should be placed at as near absolute rest as possible. This may be accomplished by either plaster-of-Paris cast, spinal brace, or by continuous traction from head and feet. Pain often has ceased abruptly after fixation of the spine. Excessive pain can be relieved by the local application of heat, by aspirin or sedatives, but often opiates will be needed. Elimination should be pushed to combat the toxæmia. In prolonged cases vaccines may be of service.

Case I.—M. B. M., male, aged fifteen years. Patient of Dr. T. H. Mackenzie of Trenton, N. J. After a week of prodromal symptoms patient went to bed the day following Thanksgiving, 1907. High fever, up to 104° F., for two weeks, constipation, tympanitis and rose spots. Three or four days after first getting out of bed in February, 1908, was hit with a severe pain in the back and along the right sciatic nerve. Following day pain shifted from right to the left sciatic nerve distribution and continued there

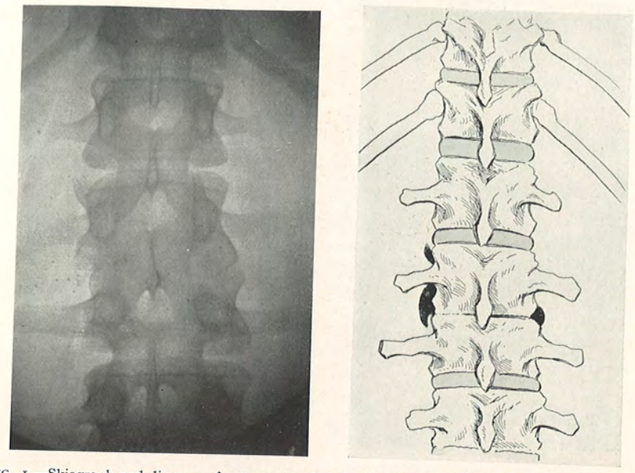

Fig. 1.—Skiagraph and diagram of anteroposterior view of Case I, taken seven years after onset of typhoid spine symptoms.

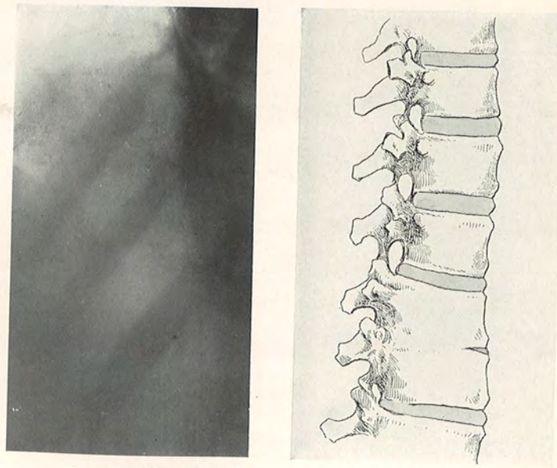

Fig. 2.—Skiagraph and diagram of lateral view of Case I.

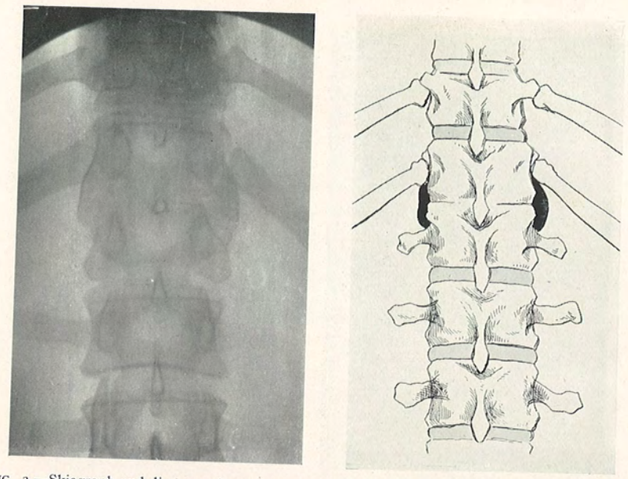

FIG. 3.—Skiagraph and diagram of anteroposterior view of Case II, taken seven years after onset of symptoms.

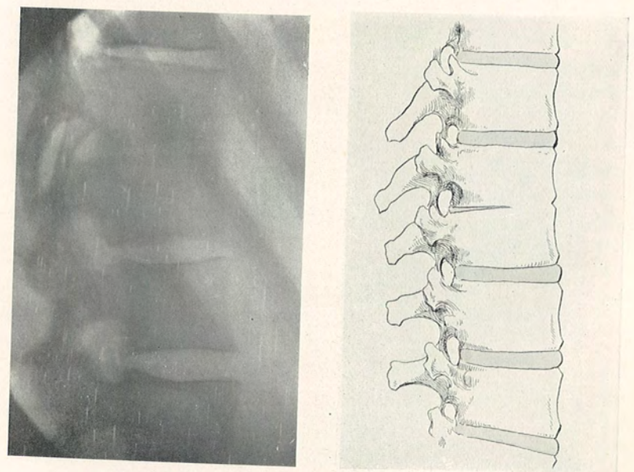

FIG. 4.—Skiagraph and diagram of lateral view of Case II.

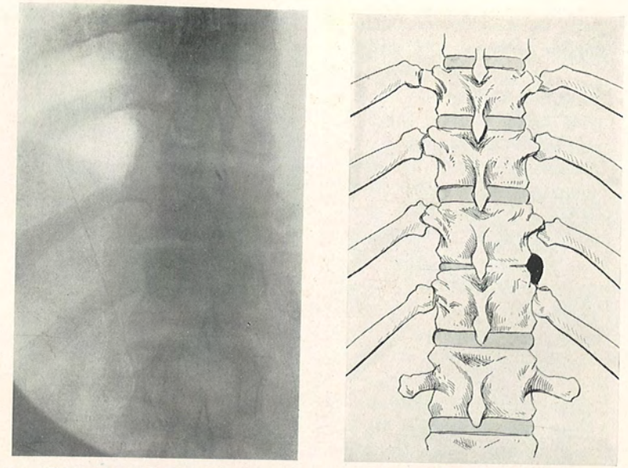

FIG. 5.—Skiagraph and diagram of anteroposterior view of Case III, six months after onset of symptoms.

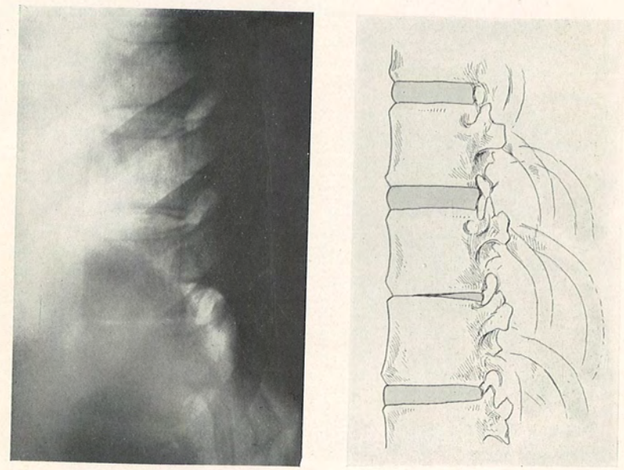

FIG. 6.—Skiagraph and diagram of lateral view of Case III.

for one month, when it stopped and pain shifted back to right sciatic for the next month. During all this time remained in bed. Had pain in lower back, made worse by movements.

Through the kindness of Dr. George H. Parker and Dr. Mackenzie I saw the patient at his home in April, 1908, at which time he complained of pain in the back and in the right sciatic distribution, both of which were aggravated by spinal movements. Right sciatic nerve was tender to the touch. Normal lumbar curve was lost. Spine was rigid. Tenderness most marked in mid-lumbar region. Made a diagnosis of typhoid spine. A plaster cast was applied by suspension method the following day, with 50 per cent. betterment in the pain within the next few days, and at end of two weeks pain had almost completely left. By end of third week cast had softened and was removed. Pain recurred in mild form. Cast reapplied for another three weeks, after which patient got up from bed and gradually resumed his activities.

His only skiagrams were taken on December 3, 1914, nearly seven years after the onset of his typhoid spine. X-rays show complete absorption of the disc between the second and third lumbar vertebræ with ankylosis between these two vertebræ. There is a slight kyphosis in this region.

He still continues to have occasional pain in form of backache, never severe and never interferes with whatever he is doing.

Case II.—J. M. A., male, twenty years of age. Painter by occupation. Indulges freely in athletic sports, musculature well developed. Normal weight 138 pounds. Height 5 feet 6 inches. Previous medical history negative. Had mild attack of typhoid fever beginning October 6, 1907. Normal course till November 1, when he developed right femoral phlebitis. Christmas day sat up out of bed for first time. Gradual resumption of activity. During the last week of January, 1908, fell on ice while skating, but experienced no ill effects at the time. On the following day experienced a sudden severe pain in the back on attempting to rise from a stooping position. Pain continued in less severe form till February 3, when it extended to the right side of the abdomen. The patient was then confined to bed and treated for lumbago. About this time there was an almost total suppression of urine. Only three ounces of urine were obtained by catheterization after a period of 20 hours. Urine highly acid, specific gravity 1028, no sugar, no albumen. Complained of slight headache and aching pain in the back of neck. Mind slightly confused and later muttering delirium. The temperature taken infrequently was subnormal until February 16, when it was 102.4° F. Thereafter was subnormal mornings and elevated in afternoons, but gradually subsiding

for next eight days, after which it remained normal and subnormal. Profuse sweating occurred during febrile period.

On February 10, patient began to have what he described as rhythmic "pulsations of the abdomen." These pulsations were slight at first and had a duration of only five or ten minutes, later on becoming more violent and persisting without intermission for hours.

The patient was examined at this stage by his brother, a physician, who observed that all of the abdominal muscles participated in violent, painful rhythmic contraction and relaxation, always at the rate of 104 or 106 to the minute, and not synchronous with the pulse. These convulsive abdominal movements would persist for upwards of six hours at a time and then cease, but on patient getting out of bed would recur in all their intensity, and were accompanied by pain at each contraction. The only relief obtainable was by having some one stand over him and press down heavily with flat hands on his abdomen. The contractions were so forcible that they almost lifted the entire weight of his heavy brother. The manual pressure would not cause contractions to cease but made them bearable. After contractions had ceased any attempt to relieve pressure immediately was followed by recurrence of contractions, but after waiting a few minutes pressure could be gradually released without recurrence.

The brother came to Philadelphia February 21, seeking advice, and the diagnosis of typhoid spine was suggested to him. He returned to the patient with the expectation of applying a plaster cast and bringing him to this city. On the night of February 21, the muscular spasms were the most violent they had been at any time and persisted without remission all night long, then ceased abruptly and patient slept continuously for 36 hours thereafter and remained drowsy and stupid for several days without contractions or pain. On March 6, following a trip to the toilet, mild contractions and pain recurred for a few minutes. It was noted that the normal lumbar lordosis was lost and that spine was straight for 14 inches.

On March 10 there were noted feeble contractions on the left side with pain and a "sore spot" in left iliac region.

On March 12, 1908, he entered the University of Pennsylvania Hospital. He was 20 pounds under weight. Complained of slight pain in left flank when he began to move about, but pain ceased on further movements. Abdomen was slightly rigid anteriorly and laterally on left side; some rigidity of spine and loss of normal lumbar curve but no kyphosis. There was a point of tenderness on deep pressure posteriorly at the side of the last dorsal vertebra. Reflexes normal.

Skiagrams taken on March 15 disclosed a small area of osteoporosis of last thoracic vertebra and small amount of bone proliferation on the left side of body of same vertebra. X-ray pictures of the spine in those days were not very clear cut and the exact details of lesion were uncertain. Patient left hospital the following day without notice.

I next saw him November 26, 1914. He stated that he had no further trouble after leaving the hospital and was soon able to get about freely and in a couple of months returned to his occupation of painting railroad cars.

In the fall of 1908 he practised cross-country running of 7 and 8 miles daily with fellow-members of a club, and the same fall, and yearly since then, has played regularly on a foot-ball team. Although a small-sized man he is able to lift a 100-pound weight above his head with one hand. He has not experienced any difficulty whatsoever from his spinal lesion.

On examination his spine has normal outlines, is supple, and gives no evidence of kyphosis. The X-ray, however, November 26, shows complete absorption of the intervertebral disc between the last thoracic and first lumbar vertebræ, with approximation of these two vertebræ and complete bony union along their lateral ligaments.

CASE III.—J. W. C., male, aged twenty-nine. Professional base-ball pitcher. Four years ago mild catarrhal jaundice for ten days. Eight months ago mild attack of pleurisy, uncertain as to which side of chest. Venereal history negative.

March 20 to 24, 1913, violent gastro-intestinal disturbance, at Birmingham, Alabama, following ingestion of tainted food, with gradual recovery.

April 10, 1913, while in Boston, began to feel generally miserable and developed fever, because of which he returned to Philadelphia, his home city. Widal reaction negative weekly for four weeks, and then positive, at which latter time rose spots first appeared and were numerous for few days, then disappeared; mild abdominal tympany. Spleen not palpably enlarged. Temperature up to 102° and 103° F.

On May 10 temperature, having been around 99° for four days, abruptly rose to 103° coincident with onset of pain and tenderness over gall-bladder; no jaundice. Fever continued at 101° to 103° for ten days, then gradually declined, but some soreness persisted over gall-bladder.

On June 10, sufficiently recovered to go to Atlantic City. June 25, went to Maine. Soreness still present in biliary region. Applied a fly blister, and soreness ceased. August 1, rejoined his

team in Philadelphia against his physician's advice, went on western trip and gradually resumed active exercise.

September 1, while swinging bat at a pitched ball, was seized with violent pain over the lower ribs on the right side. Rested for several minutes, then was able to bat balls to the infield, although it caused him considerable pain. After going to bed that night pain recurred with increased severity and he developed a temperature of 106° F. with delirium. Pain increased by deep breathing but no friction sounds audible. Strapping of chest gave marked relief. Was ordered general sponge baths and colonic irrigations. Following day temperature 104–105°, then returned to near the normal in five or six days. Pain located at right costovertebral angle continued in lessening severity, and was made worse by motion such as turning in bed; rigidity and tenderness of upper right abdomen. His symptoms were suggestive of possible diaphragmatic pleurisy, or of infection in gall-bladder, liver or kidney, or in subdiaphragmatic or perirenal regions.

I saw the patient for the first time on September 12. Temperature was then 99.6°, pulse 90, and respiration 20. He complained of pain in upper right abdomen. Pain was most severe at night, when it would persist for hours, preventing sleep, but would disappear during day while at complete rest in bed, only to reappear on motion, as getting out of bed or turning in bed, and had diffuse tenderness over upper right anterior and lateral abdomen and hepatic area. Most marked point of tenderness was at right costovertebral angle. Lungs and pleura showed no abnormalities; deep inspiration no longer painful; reflexes normal. On sitting up in bed pain was increased and he supported his weight by his hands in the way characteristic of acute spinal cases. Being asked to raise his hands said he could not do so, as back felt "too weak" to sit up unsupported. Spinal muscles were tense on both sides and the dorsolumbar spine was rigid. Tenderness over last dorsal and first lumbar vertebræ was slight in the median line but more marked over right transverse processes of same vertebræ. Reflexes were normal. On standing erect he supported his body weight by his hands placed on pelvis. On attempting to pick up an object from the floor he kept spine rigid and flexed the hips and knees in the same way as a case of acute Pott's disease. Downward pressure on head or shoulders evoked complaints of increased abdominal pain. He was returned to bed when it was observed that he had slight rhythmical alternating contraction and relaxation of his upper right abdominal muscles for the next two or three minutes, and pain was so aggravated by the various manipulations that it persisted in severe form for a full hour. Curiously enough the local pain in the spine was so

trivial in comparison to the referred pain in the upper abdomen that it was only with extreme difficulty that this intelligent patient could be convinced that the trouble was in the spine and not within the abdomen. A diagnosis of typhoid spine was made and the patient was sent to the University of Pennsylvania Hospital. Radiographs of the spine taken the following day (September 13) and on September 14 and 16 failed to show any abnormalities. He was kept at rest in bed. Pain was most marked at night and apparently was relieved somewhat by a hot-water bottle. On September 16 a plaster cast was applied from axillæ to the hips without relief of pain. Aspirin and bromides had no effect. Morphia was required for sleep. Three days of the cast had no effect on the pain, and in response to the patient's urging it was removed to enable him to reapply the hot-water bottle which he would place over the lateral wall of the abdomen and chest rather than over the spine. The urine repeatedly exhibited a trace of albumen, many hyaline and granular casts, an occasional red blood-cell, and great excess of leucocytes, but by October 1 the red cells and excessive leucocytes had disappeared from the 24-hour specimen. Examination of the blood showed 4,470,000 red cells, 9900 leucocytes and 80 per cent. hæmoglobin. The differential count gave 56 per cent. polymorphonuclears, 31 per cent. lymphocytes, 7 per cent. large mononuclears, 4 per cent. transitionals, and 1 per cent. eosinophiles.

On repeated leucocyte counts the highest number obtained was 11,100 on October 3. Widal test (September 27) was positive; Wassermann (September 25) and Von Pirquet (October 1) tests were negative. Blood cultures (October 3) were sterile. From a culture of the fæces (October 1 and October 10) a paratyphoid organism and non-motile, rod-like bacteria of the aërogenes type were isolated. Urine was examined bacteriologically but report has been lost. Nothing very suggestive was found.

His temperature the first five days after admission to the hospital varied daily between 98° and 99°, then showed an upward trend and for twelve days ranged chiefly between 99° and 101°, going down occasionally to 97.6° and up to 102°. On October 1, the day extension was applied to head and neck, the temperature reached 102°. The following day it did not go above 99.6°, and thereafter continued lower, being entirely normal or subnormal during his last month in the hospital.

On September 20 and November 22, 1913, exhaustive general examinations from the neurological stand-point were made by Dr. Wm. G. Spiller. The only deviation from the normal he could discover was a diminution in the intensity and promptness of the

right upper abdominal (epigastric) reflex at the first examination, but this defect was barely noticeable at the second.

Beginning on September 17 and continued daily thereafter for two weeks, colonic irrigations of from two to three quarts of normal saline solution were employed at the suggestion of Dr. Alfred Stengel, who had observed following this treatment prompt cessation of symptoms in a number of similar post-typhoidal cases. The irrigations seemed especially appropriate in this case because of a year's long constipated tendency, but they had no beneficial effect on symptoms and were discontinued because the manipulations attending their administration and expulsion aggravated the pain. Thereafter the constipation was corrected by paraffin oil aided by various laxatives.

From the time the patient entered the hospital he continued to have intermittent pain and intermittent rhythmical spasms of the muscles on the right side of the abdomen. The pain and rhythmical spasms might occur together or independently of one another, and either or both would be excited by movements in bed. When either or both were present they might persist for a few minutes only, or for hours at a time. Pain was particularly severe for hours continuously almost every night, partially relieved by hot-water bottle, but sleep often not obtained by anything short of opiates. The rhythmical spasms were synchronous with the pulse, were observed chiefly on the right side, and then would pull linea alba to the right. After cessation of a long continuance of the spasms the muscles would be sore as after vigorous exercise in one unaccustomed to it. Adhesive strapping and tight circular bandaging of the abdomen, applied during times cast was off, somewhat relieved the distress of the rhythmic contractions but did not stop them. During the intervals free from rhythmic contractions the muscles of the upper right abdomen were more or less rigid. Efforts at deep palpation excited an increase in the rigidity.

On September 26, X-rays were negative. Plaster cast was applied that day, but with no relief, and was removed two days later. Cast reapplied morning of September 30, under different conditions from former ones, but pain being made worse it was removed in the evening of the same day. On October 1, obtained a longer bed for patient and applied extension to head and legs, which was continued until November 5. This was promptly followed by relief of pain and spasms, and after two days they both ceased entirely for several days. On October 15 X-rays were negative. About this time a recurrence of marked pain, tenderness and rigidity in upper right abdomen without muscle spasm again raised the serious question which had already been considered frequently, as to whether or not there was an intra-abdominal or retroperitoneal abscess. The history of two previous attacks of biliary trouble, the preceding urinary findings, and the negative X-rays at this late stage of the spinal disease, all contributed to the difficulty of the situation. The right-sided symptoms, however, suddenly ceased and a day or two later mild pain, tenderness, rigidity and muscular spasms appeared on the left side for the first time. The left-sided symptoms were never severe and disappeared in a few days.

On November 5 was measured for a spinal brace, but to enable him to sit up in bed at once a plaster cast was applied. The cast proved uncomfortable and sitting up in it caused mild recurrence of right-sided pain and twitching, and it was removed on November 8. Thereafter no pain except when he turned in bed. November 15, the spinal brace applied. November 18, X-rays for first time demonstrated slight changes in the form of absorption and new bone deposit along the edges and sides of the bodies of the eleventh and twelfth thoracic vertebræ. On November 26, out of bed for first time, and on November 28 left the hospital, being then able to walk with difficulty, owing to muscular weakness. An X-ray taken December 17 showed narrowing of intervertebral space and more bone deposit. He continued to wear the spinal brace till February, 1914, when parts of it were removed, and a month later began leaving brace off part of each day, finally abandoning it altogether about May 15. In July he began light exercise and at end of August was given permission to go the limit in exercise. He was not able to regain his old-time form as a pitcher before the end of the season, but this seems more likely to have been due to his not having pitched for two seasons, during which he passed through two prolonged illnesses, rather than to any difficulty existent in the spine. He could pitch fast balls satisfactorily but did not have the usual control over his curves. As he described the situation, his pitching was of his usual calibre at the beginning of previous seasons, and with more practice he felt he would regain control as he had in previous years as the season progressed.

His last X-ray was taken on March 17, 1914, and shows absorption of the intervertebral disc with ankylosis of the eleventh and twelfth thoracic vertebræ. He had no kyphosis, no pain nor tenderness and no apparent limitation of spinal movement when last examined in August, 1914.

Case IV.—J. H., male, thirty-seven years of age; Belgian; sailor. Admitted to service of Dr. Alfred Stengel at University of Pennsylvania Hospital on September 5, 1914. Had been ill for six days. On admission, tongue coated, spleen uncertainly palpa-

ble, considerable tympanites; temperature 102° F., pulse 124, hæmoglobin 60, red blood-cells 4,090,000, white blood-cells 4800, urine a trace of albumin, hyaline and granular casts. Widal positive two days later.

On September 20 had urticarial eruption on back and right arm which left the following day. By October 30 temperature practically normal.

On November 2 complained of pain in left iliac and left sacro-iliac regions. On November 4 sacro-iliac region was strapped with adhesive plaster. On following day it was noted strapping had not relieved pain; on November 8 was still complaining of some pain and there was some tenderness over left sacro-iliac joint.

On November 10 it was noted that pain and tenderness were not constant. On November 18 X-rays of spine, sacro-iliac joints and right hip negative. On November 20 pain variable. Patient refused to sit up though encouraged to do so.

On December 3, I first saw the patient by the invitation of Dr. Stengel, who has kindly permitted me to report this case from his service.

Patient is a Belgian, at present somewhat neurotic, and, by reason of his understanding English only imperfectly, it is rather difficult to obtain accurate information from him. He complains of pain in the lower back, right sacro-iliac region, right lower abdomen and right thigh. He presents distinct localized tenderness posteriorly over the middle and lateral aspects of the third lumbar vertebra and over the right sacro-iliac joint. Anteriorly there is no midline tenderness at or above the umbilicus on deep pressure. Below the umbilicus fairly deep pressure does not cause any distress, but on making firmer pressure so that the palpating fingers finally come in contact with the body of the third lumbar vertebra the patient cries out and squirms away from the examiner's hand.

The normal lumbar curve is lost and the lumbar spine is held rigidly. Efforts at forward or lateral flexion or hyperextension cause pain. The patient turns over or sits up in bed with difficulty because of increased pain. He apparently has ample strength to handle himself readily but on moving exhibits the awkwardness characteristic of patients having an acute spinal inflammation. On sitting up with his feet over the side of the bed he persists in supporting his weight by his hands placed on the mattress. Downward pressure on his head causes pain in the midlumbar region. His knee-jerks are present and equal on the two sides.

A second set of X-ray pictures were taken with negative results. On December 8 weight extension was applied to both legs and in 48 hours all of his pains were decidedly better. On

December 9 daily colonic irrigations with normal salt solution were begun. On December 19, 1914, hæmoglobin 80 per cent., red blood-cells, 5,310,000, leucocytes 9000. Patient continued to improve. On January 2, 1915, leg extension discontinued because pain had practically disappeared, but remained in bed till January 19, when he was up in wheel chair for first time, and his fourth X-ray was negative. Sacro-iliac tenderness is gone. Lumbar spine still rigid. Lumbar curve still wanting. Has distinct tenderness over lateral aspects of third lumbar vertebra, but median tenderness nearly absent.

He is being skiagraphed each week both with expectation of showing bone changes ultimately in his lumbar spine and with intention of ascertaining at what stage organic changes sufficient to be shown by the X-ray take place.

REFERENCES

Cutler: Boston Med. and Surg. Jour., cxlvi.
Elkin and Halpenny: British Journal of Surgery, vol. i, 1913–1914.
Elmer: Trans. Acad. Surg., Philadelphia, 1912, xiv.
Fraenkel: Mitteil a. d. Grenzgebeit d. Med. u. Chir., 1903, xii.
Gaudefroy: Contribution a l'Etude des Complications Osseuses de la Fievre Typhoide, 1913, Lille.
Gibney: Trans. Orthop. Assn., 1889, ii.
Halpenny: Surg., Gyn. and Obst., December, 1909.
Osler: Johns Hopkins Hospital Reports, vol. iv, 1895, 73.
Quincke: Mitteil a. d. Grenzgebeit d. Med. u. Chir., 1898–1899, iv.
Rogers: Bost. Med. and Surg. Jour., March 6, 1913.
Rugh: Personal communication on case to be reported.
Silver: Amer. Jour. Orthop. Surg., 1907–1908, v.

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