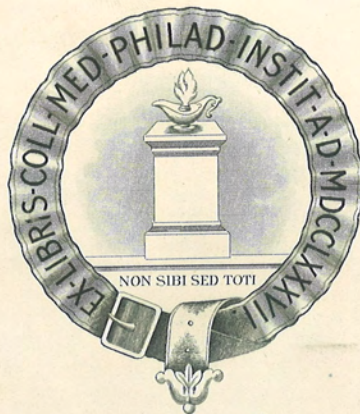




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TRANSACTIONS
OF THE
PHILADELPHIA
ACADEMY OF SURGERY

VOLUME XIII



PHILADELPHIA
PRINTED FOR THE ACADEMY
1911

NOTICE

The present volume of *Transactions* contains the papers read before the Academy from January, 1910, to December, 1910, inclusive.

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ACTIVE FELLOWS OF THE PHILADELPHIA
ACADEMY OF SURGERY

- 1910.* ALEXANDER, E. G., M.D., 1627 Oxford Street. Surgeon to the Out-Patient Department of the Episcopal Hospital; Surgeon to the Out-Patient Department of the Mary J. Drexel Home for Children; Assistant Surgeon to the Kensington Hospital for Women; Demonstrator of Fracture Dressings at the Jefferson Medical College; Demonstrator of Fracture Dressings at the Woman's Medical College.
1905. ALLEN, FRANCIS OLCOTT, JR., M.D., 323 S. Sixteenth Street. Dispensary Surgeon to the Presbyterian Hospital; Dispensary Surgeon to the Methodist Hospital.
- † ALLIS, OSCAR H., M.D., 1604 Spruce Street. Surgeon to the Presbyterian Hospital; Member American Surgical Association.
1906. ASHHURST, ASTLEY P. C., M.D., 2000 West De Lancey Place. Surgeon to the Out-Patient Department of the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital; Surgeon to the Dispensary of the Children's Hospital; Chief of the Gynæcological Dispensary of the Pennsylvania Hospital; Prosector to the Associate Professor of Applied Anatomy in the University of Pennsylvania.
1898. BOGER, JOHN A., A.M., M.D., 2213 N. Broad Street. Surgeon to St Mary's and the Samaritan Hospitals; Surgeon to the Dispensary of the Episcopal Hospital.

* Figures denote year elected to membership.

† Denotes Original Fellows.

1905. BROOKS, MACY, M.D., 1314 Spruce Street. Assistant Genito-Urinary Surgeon, Philadelphia Hospital; Chief of Out-Patient Surgical Department of the University of Pennsylvania and Howard Hospitals.
1907. CARMANY, HARRY S., 366 Green Lane, Roxborough. Surgeon to St. Timothy's Hospital; Out-Patient Surgeon to Episcopal Hospital.
1909. CARNETT, JOHN B., 318 S. Fifteenth Street. Associate in Surgery, University of Pennsylvania, Medical Department; Assistant Surgeon to the University and Philadelphia General Hospitals; Consulting Surgeon to the Phoenixville Hospital.
1896. DA COSTA, JOHN CHALMERS, M.D., 2045 Walnut Street. Professor of the Principles of Surgery and Clinical Surgery in Jefferson Medical College; Surgeon to the Philadelphia Hospital.
1896. DAVIS, GWILYM G., M.D., M.R.C.S. (Eng.), 1814 Spruce Street. Assistant Professor of Applied Anatomy, University of Pennsylvania; Surgeon to the Episcopal, St. Joseph's, and the Orthopædic Hospitals.
1896. DEEVER, HENRY C., M.D., 1534 N. Fifteenth Street. Surgeon to the Episcopal, St. Agnes, Stetson, and Children's Hospital of the Mary J. Drexel Home; Professor in Surgery in Woman's Medical College.
1890. DEEVER, JOHN B., M.D., 1634 Walnut Street. Chief of the Surgical Department, German Hospital.
1908. DESPARD, DUNCAN LEE, M.D., 1806 Pine Street. Instructor in Surgery, Jefferson Medical College; Chief Assistant in the Surgical Clinic at Jefferson Medical College.

1884. DULLES, CHARLES W., M.D., 4101 Walnut Street. Lecturer on the History of Medicine, University of Pennsylvania; Consulting Surgeon to the Rush Hospital.
1909. ELMER, WALTER G., M.D., 1801 Pine Street. Instructor in Orthopædic Surgery in the University of Pennsylvania and Assistant Orthopædic Surgeon to the University Hospital; Orthopædic Surgeon to the Jewish Hospital; Surgeon to the Presbyterian Hospital Dispensary; Surgeon to the Pennsylvania Training School for Children at Elwyn.
1898. FRAZIER, CHARLES HARRISON, M.D., 1724 Spruce Street. Professor of Clinical Surgery, University of Pennsylvania; Surgeon to the University Hospital, and Episcopal Hospital.
1899. GIBBON, JOHN H., M.D., 1608 Spruce Street. Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College; Surgeon to the Pennsylvania and Bryn Mawr Hospitals; Consulting Surgeon to the Woman's Hospital.
1902. GIRVIN, JOHN H., M.D., 3924 Walnut Street. Gynæcologist to the Presbyterian Hospital; Instructor in Obstetrics, University of Pennsylvania.
1892. HARTE, RICHARD H., M.D., 1503 Spruce Street. Associate Professor of Surgery, University of Pennsylvania; Surgeon to the Pennsylvania Hospital, and to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to St. Mary's, St. Timothy's, and Bryn Mawr Hospitals.
1882. HEARN, W. JOSEPH, M.D., 1120 Walnut Street. Emeritus Professor of Clinical Surgery, Jefferson Medical College; Surgeon to the Philadelphia Hospital; Consulting Surgeon to the Phoenixville Hospital, and to the General Hospital of Salisbury, Md.

1890. HEWSON, ADDINELL, M.D., 2120 Spruce Street. Surgeon to St. Timothy's Hospital; Professor of Anatomy, Philadelphia Polyclinic and College for Graduates in Medicine.
1905. HODGE, EDWARD B., M.D., 346 S. Sixteenth Street. Surgeon to the Children's Hospital; Surgeon to the Out-Patient Department of the Pennsylvania Hospital; Dispensary Surgeon to the Presbyterian Hospital; Assistant Surgeon to the Orthopædic Hospital.
1890. HORWITZ, ORVILLE, B.S., M.D., 1721 Walnut Street. Professor of Genito-Urinary Surgery, Jefferson Medical College; Surgeon to the St. Agnes Hospital and the State Hospital for the Insane; Consulting Surgeon to the Jewish Hospital.
1898. HUTCHINSON, JAMES P., M.D., 133 S. Twenty-second Street. Surgeon to the Pennsylvania, St. Timothy's, Methodist Episcopal, Children's, and Bryn Mawr Hospitals.
1900. JOPSON, JOHN H., M.D., 1824 Pine Street. Surgeon to the Presbyterian, Children's, and Bryn Mawr Hospitals, and to the Philadelphia Home for Incurables.
- † KEEN, WILLIAM W., M.D., LL.D., F.R.C.S. (Hon.), 1729 Chestnut Street. Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Membre correspondant étranger de la Société de Chirurgie de Paris; Membre honoraire de la Société Belge de Chirurgie, Ehrenmitglied der Deutsche Gesellschaft für Chirurgie; Honorary Member of the Clinical Society of London.
1910. KELLY, JAMES A., M.D., 1621 N. Seventeenth Street. Surgeon to St. Mary's Hospital; Associate in Surgery and Pathologist to the Philadelphia Polyclinic Hospital and College for Graduates in Medicine.

1895. LE CONTE, ROBERT G., M.D., 1530 Locust Street. Surgeon to the Pennsylvania and Bryn Mawr Hospitals; Consulting Surgeon to the Germantown and Gynecean Hospitals.
1910. LEE, WALTER E., M.D., 905 Pine Street. Gynecologist to the Out-Patient Department of the Pennsylvania Hospital; Surgeon to the Dispensary of the Germantown Hospital.
1899. LOUX, HIRAM R., M.D., 1614 N. Broad Street. Associate Professor of Genito-Urinary Surgery, Jefferson Medical College; Surgeon to the Philadelphia Hospital.
1885. MCCLELLAN, GEORGE, M.D., 1116 Spruce Street. Professor of Anatomy, Jefferson Medical College; Consulting Surgeon to Howard Hospital; Professor of Anatomy, Pennsylvania Academy of the Fine Arts.
1900. MARTIN, EDWARD, M.D., 1506 Locust Street. Professor of Clinical Surgery, University of Pennsylvania; Professor of Clinical Surgery, Woman's Medical College; Surgeon to the Philadelphia, University of Pennsylvania, and Howard Hospitals; Consulting Surgeon to the Bryn Mawr, Phoenixville, Wernersville, and Norristown Hospitals.
1907. MILLER, MORRIS BOOTH, M.D., 2117 Pine Street. Professor of Surgery, Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Surgeon, Philadelphia General Hospital; Surgeon to the Douglas Hospital.
1904. MITCHELL, CHARLES F., M.D., 1503 Spruce Street. Surgeon to the Germantown Hospital; Assistant Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to the Eastern State Penitentiary; Surgeon to the Out-Patient Department of the Pennsylvania Hospital.

1906. MULLER, GEORGE P., M.D., 334 S. Fifteenth Street. Associate in Surgery in the University of Pennsylvania; Surgeon to St. Christopher's Hospital; Assistant Surgeon to the University Hospital, Philadelphia Hospital, and the Home for Crippled Children; Consulting Surgeon to the Chester County Hospital.
1902. MUTSCHLER, LOUIS H., M.D., 2030 Tioga Street. Surgeon to the Dispensary of the Episcopal Hospital; Surgeon to the Dispensary of the Samaritan Hospital; Assistant Surgeon to the Orthopaedic Hospital.
1905. NASSAU, CHARLES F., M.D., 1831 Chestnut Street. Surgeon to St. Joseph's Hospital; Consulting Surgeon to the Frankford Hospital; Prosector, Jefferson Medical College (Chair of Regional Anatomy).
1890. NEILSON, THOMAS R., M.D., 122 S. Seventeenth Street. Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Clinical Professor of Genito-Urinary Diseases in the University of Pennsylvania.
1906. NORRIS, HENRY, M.D., Rutherfordton, North Carolina.
1890. PENROSE, CHARLES B., M.D., Ph.D. (Harvard), 1720 Spruce Street.
- † ROBERTS, JOHN B., M.D., 313 S. Seventeenth Street. Professor of Surgery in the Philadelphia Polyclinic; Surgeon to the Methodist Hospital.
1898. ROBINSON, J. WEIR, M.D., 326 S. Sixteenth Street. Assistant Surgeon to the Presbyterian Hospital.

1900. RODMAN, WILLIAM L., M.D., LL.D., 1904 Chestnut Street. Professor of the Principles of Surgery and Clinical Surgery, Medico-Chirurgical College of Philadelphia; Surgeon to the Medico-Chirurgical Hospital, Presbyterian, and the Philadelphia General Hospitals.
1900. ROSS, GEORGE G., M.D., 1721 Spruce Street. Surgeon Germantown Hospital; Assistant Surgeon, German Hospital; Surgeon to the Out-Patient Department, German Hospital; Assistant Surgeon, University Hospital; Instructor in Surgery, University of Pennsylvania.
1894. SHOEMAKER, GEORGE ERETY, A.M., M.D., 1831 Chestnut Street. Gynæcologist to the Presbyterian Hospital.
1909. SHOBER, JOHN B., B.A., M.A., Princeton, M.D., University of Pennsylvania. Associate Surgeon, Gynæcean Hospital, Philadelphia; Surgeon, Bar Harbor Medical and Surgical Hospital.
1903. SITER, E. HOLLINGSWORTH, M.D., 2038 Locust Street. Surgeon to the Out-Patient Department, St. Agnes' Hospital; Surgeon to the Out-Patient Department of the Children's Hospital; Chief Surgeon, Genito-Urinary Diseases of the University Hospital; Instructor in Genito-Urinary Diseases, University of Pennsylvania, Surgeon of the British Consulate.
1909. SPEESE, JOHN, M.D., 248 S. Twenty-first Street. Instructor in Surgery, University of Pennsylvania; Surgeon to the Out-Patient Department of the University Hospital and the Children's Hospital.

1898. SPELLISSY, JOSEPH M., A.M., M.D., 110 S. Eighteenth Street. Surgeon to the Methodist and to St. Joseph's Hospitals, the Elwyn Training School, and to the Out-Patient Department of the Pennsylvania Hospital; Assistant Surgeon to the Orthopædic Department of the University Hospital.
1890. STEINBACH, LEWIS W., M.D., 1309 N. Broad Street. Professor of Surgery, Philadelphia Polyclinic; Surgeon to the Philadelphia and to the Jewish Hospitals.
1903. STEWART, FRANCIS T., M.D., 311 S. Twelfth Street. Surgeon to the Germantown Hospital; Professor of Clinical Surgery in Jefferson Medical College; 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, University of Pennsylvania.
1890. TAYLOR, WILLIAM J., M.D., 1825 Pine Street. Surgeon to St. Agnes' and the Orthopædic Hospitals; Consulting Surgeon to the West Philadelphia Hospital for Women.
1908. THOMAS, THOMAS TURNER, M.D., 2005 Chestnut Street. Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon to the University Hospital; Assistant Surgeon to the Philadelphia Hospital.
1907. UHLE, ALEXANDER A., M.D., 1831 Chestnut Street. Assistant Instructor, Genito-Urinary Department, University of Pennsylvania; Assistant Genito-Urinary Surgeon, Philadelphia Hospital; Surgeon to Urologic Dispensary of the German Hospital.

1907. WALKER, WARREN, M.D., 1632 Spruce Street. Surgeon to the Out-Patient Department of the Episcopal and Children's Hospitals.
1892. WHARTON, HENRY R., M.D., 1725 Spruce Street. Clinical Professor of Surgery, Woman's Medical College; Surgeon to the Presbyterian and to the Children's Hospitals; 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., 1810 S. Rittenhouse Square. John Rhea Barton, Professor of Surgery, University of Pennsylvania; Surgeon to the Rush Hospital.
1902. WHITING, A. D., M.D., 1523 Spruce Street. Surgeon to the Germantown Hospital; Assistant Surgeon to the German Hospital; Surgeon to the Southern Home for Destitute Children; Surgeon to the Out-Patient Department, German Hospital; Assistant Surgeon, University Hospital; Instructor in Surgery, University of Pennsylvania.
- † WILLARD, DE FOREST, M.D., Ph.D., 1901 Chestnut Street. Professor of Orthopædic Surgery, University of Pennsylvania; Surgeon-in-Chief, Widener Industrial Training School for Crippled Children; Consulting Surgeon to the Presbyterian Germantown, Jewish, Phoenixville, Atlantic City, Seashore and South Mountain Hospitals.
1890. WILSON, H. AUGUSTUS, A.M., M.D., 1611 Spruce Street. Professor of Orthopædic Surgery, Jefferson Medical College; Emeritus Professor of Orthopædic Surgery, Philadelphia Polyclinic; Orthopædic Surgeon to the Philadelphia Hospital; Consulting Orthopædic Surgeon to the Lying-in Charity Hospital and to the Kensington Hospital for Women.

1898. WOOD, ALFRED C., M.D., 128 S. Seventeenth Street. Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, Philadelphia and St. Timothy's Hospitals; Consulting Surgeon to Charity Hospital and the State Hospital for the Insane, Norristown.
1910. WOODS, RICHARD F., M.D., 1501 Spruce Street. Gynæcologist, Presbyterian Hospital; Associate Gynæcologist, Gynecæan Hospital.
1902. YOUNG, JAMES K., M.D., 222 S. Sixteenth Street. Professor of Orthopædic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopædic Surgery, Woman's Medical College of Pennsylvania; Associate in Orthopædic Surgery, University of Pennsylvania; Assistant Orthopædic Surgeon, Hospital of the University of Pennsylvania.

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1881 *THEODOR BILLROTH..... Vienna, Austria.
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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. DENANCREDE.....	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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THE PATIENCE OF SURGERY.¹

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IN the noble lines² with which he opens the second book of his great poem, one of the most divine of Latin writers describes the satisfaction with which one safe on shore watches the struggles, amidst the waves of a tempestuous sea, of a ship-wrecked companion whose perils he has shared, but whom he has out-distanced to land; narrates the joy with which one, assured of his own safety, might witness opposing armies meet upon the battle plain; and, finally, the greatest pleasure of all, that of contemplating from the secure and lofty heights of philosophy, the doubts, the dangers, and the wanderings of those who, gradually but with inevitable success, grope in the dark caverns of error after the illuminating brilliancy of truth.

¹ Annual address before the Philadelphia Academy of Surgery; delivered April 25, 1910.

² "Suave, mari magno turbantibus æquora ventis,
E terra magnum alterius spectare laborem:
Non quia vexari quemquam est jucunda voluptas,
Sed, quibus ipse malis careas, quia cernere suave est.
Suave etiam belli certamina magna tueri
Per campos instructa, tua sine parte pericli;
Sed nil dulcius est bene quam munita tenere
Edita doctrina sapientum templa serena:
Despicere unde queas alios, passimque videre
Errare, atque viam palantes quærere vitæ;
Certare ingenio; contendere nobilitate;
Noctes atque dies nit¹ præstante labore
Ad summas emergere opes, rerumque potiri."

Lucretius: de Rerum Natura.

So may surgeons of today, in a yet nobler manner, rejoice in the contemplation of the former days, ere the progress of their science and the development of their art endowed them with the ability to meet and to overcome innumerable conditions previously considered incurable.

It is, therefore, with no apology, that on this annual occasion I ask you to consider with me for a few moments the evolution of our surgery as we know it today; to watch our forefathers in their trials, their errors, and their triumphs; and to deduce from the history of their careers and from the gradual progress of the art from their day to this, some lessons of benefit for the future, and perchance of pleasure in the learning.

It is a wise saying that the greatest pleasure in life consists in solving problems; and surely one of the chief charms of surgery lies in the multitudinous problems which are constantly presented for solution. That surgeon who perceives no problems, to whom every procedure is cut and dried, to whose crystallized mind the second member of an equation invariably follows the first, as day does night, without hesitation or uncertainty; that surgeon, believe me, knows not the highest pleasures of his art. He does everything by authority; he dares not vary the terms of the problem, because he is incapable of working out a new solution for himself. He repeats, in middle and advancing age, the failures, as well as the successes, of his youth; he does a certain amount of routine work, and does it well, up to a certain point; he is a good imitator, but he has no initiative. No one need look to him for inspiration in methods or in principles. He is supine; he is not patient.

To another surgeon, everything is a problem. He is aware that certain surgical problems have been solved by his predecessors; but being possessed of an open mind he is willing to believe that even classical methods are capable of improvement; he perceives that, though the problem has been solved by others, it is nevertheless possible that it might be solved in another and a better way. In some departments of surgery he is almost satisfied with the results, not always because he thinks they are the best attainable, but because he is unable, at the time, to see any way out of the difficulty; the problem is too hard for him. But later, it may be long years after, he recurs anew to the same problem,

and finds that with his added experience, and with the habit of solving problems ingrained in his nature, he is now able to see the direction in which he must work if a better solution is to be obtained. That surgeon is patient.

Consider, for example, the patience of Marion Sims in his efforts to solve the problem of the surgical cure of vesicovaginal fistulæ. In his first successful case he had operated unsuccessfully on thirty different occasions; on other patients he had operated more than forty times. Imagine the discouragement (some of you know it well) when the surgeon sees the progress made in three or four previous attempts melt away in the sloughing which follows the last operation. Today, thanks to progress in other departments of surgery, vesicovaginal fistulæ are of rare occurrence, and when encountered are capable of being cured much more readily than in the day of Sims.

In plastic operations to correct the deformities caused by burns, in operations for hypospadias, etc., the surgeon's patience is tried to the utmost; and it is only by sad experience that he learns not to attempt too much at any one operation, and that he begins to appreciate the old proverb "Leg over leg a dog must go to Dover."

Other examples could readily be cited, such as the treatment of ununited fractures, or osteomyelitis and coxalgia; of congenital dislocations of the hip, or of club foot; of fæcal fistula and strictures of the urethra or œsophagus; where this precious quality of patience is in extreme demand, and where it is on the head of the patient surgeon alone that success finally places her laurel crown.

But beyond the patience of the individual surgeon, and greater because impersonal, is the patience of Surgery herself. Any individual surgeon can do comparatively little during his short sphere of existence here on earth, to advance the science or art of surgery; the utmost span of a hard-working life is scarcely sufficient to enable him to hew from the quarry and prepare for the architect one or two stones suitable for the temple which is still building, though its foundations were laid so many centuries ago. True progress is always slow, usually laborious; and it is difficult to appreciate it in contemporaneous events. It is only by looking backward, and contemplating the problems of surgery at some past age, and then perceiving that those problems were solved,

more or less perfectly, years and years ago, that we can in any true sense appreciate our position today

Anæsthesia. Take the question of anæsthesia, for instance. The pain suffered by patients during surgical operations was the *bête-noir* of surgery for centuries. The actual pain, and in perhaps no less degree, the struggles or the involuntary movements of the patients rendered impossible then many operations performed routinely today, and which the surgeons of those days were eminently qualified to perform, if only the patient could have been rendered insensible to pain, and have had his muscular system temporarily paralyzed. An operation was considered of amazing and perilous length if it was not concluded in fifteen or twenty minutes at the most; one which lasted "near half an hour" is mentioned with awe; no complete dissections could be made, for fear an unguarded movement of the patient should cause the scalpel to deviate from its course, with fatal wounding of an important blood-vessel; no necks could be relieved of tuberculous lymph nodes, and no axillas cleared of cancerous metastases during life. What would not one give to watch Astley Cooper do the modern operation for carcinoma of the breast; or to see Cheselden take out a prostate through the perineum!

Compare with modern methods those employed during the eighteenth century for the removal of carcinomatous breasts—then one of the few major operations, besides amputations, ever attempted. The breast was supported and drawn away from the chest wall either by a harpoon-like instrument, which was thrust under the breast close to the superficial surface of the pectoralis major; or else two long cords or slender ropes were thrust under the breast, at right angles to each other, by means of long, sharp-pointed bodkins; the diseased breast being thus steadied and drawn away from the thorax as far as possible, the surgeon grasped a long and sharp knife (somewhat like that used nowadays by pathologists for sectioning the brain), and with one masterly stroke the breast was slashed off the chest wall. Another method mentioned, though not commended, by Heister, consisted in the use of an instrument working on the principle of the guillotine: two curved arms of steel embraced the breast, while a curved blade, shaped like a gardener's sickle, and working in a slot between the two arms, sliced the breast off the chest wall. Yet these methods of operating were humane and

gentle compared to those employed at a still earlier time. Fabricius ab Aquapendente (in the sixteenth century) cut off the cancerous breast with a red hot knife, which seared or burned as it cut, thus preventing the dreaded hemorrhage.

It is small wonder that operating was rapid. Even the reduction of dislocations was hampered by the uncontrollable muscular rigidity. Sir Astley Cooper recommends, in addition to bleeding these patients, that enough tartar emetic be given to produce nausea; for he had found, if the patient's attention was thus distracted from the dislocated extremity and focussed upon his diaphragm, that the muscular rigidity of the part was considerably reduced. You no doubt remember the plan adopted by Abernethy to catch these muscles off their guard: being called to attend a grand lady of the court, with a dislocation of the shoulder, and having in vain tried various manipulations, but always being hindered by the persistent muscular contraction, he deliberately laid the limb down, and, fixing the lady with his eye, exclaimed in a stern and solemn voice: "Madam, I perceive that your ladyship is drunk;" and during the momentary horror which overcame her at the mere thought that the great brute of a surgeon should speak so to her of all people, Abernethy seized the arm, and with a dexterous twist reduced the luxation before she had recovered from her dismay.

Nevertheless, the problem of anæsthesia was always before their eyes. Yet the most they could do was to bleed the patient until he was in a faint; to drug him up with opium and whiskey; or even to distract his attention with conversation and persiflage; and then to plunge in with the bistoury and get through in the shortest possible time.

But though the year 1846 seemed to have solved the problem of surgical anæsthesia, there were further advances yet to be made on the same problem. Ophthalmologists recognized the drawbacks of the straining and struggling frequently attendant upon the administration of a general anæsthetic, and the peril of post-anæsthetic vomiting; and to avoid these, as well as to avail themselves of the intelligent coöperation of the patient, they welcomed with delight the introduction, in 1884, of cocaine, the new local anæsthetic; and there can be little doubt that the immense advances in the so-called "specialties" are largely due to the introduction of this drug.

Nor yet were surgeons satisfied. Was a patient with a wen on the

forehead, or one with a needle in the hand, to be condemned either to general anæsthesia, with its dread of the unknown, or to suffer the pains of even a trifling surgical operation? This problem was soon solved by the endodermic and hypodermic use of cocaine; and this naturally led up to intraneural injections by means of which operations of such magnitude as amputations of the leg, resections, etc., can be painlessly performed, if need be, without the use of a general anæsthetic. In these latter years, moreover, have we not had introduced as a valuable and life-saving remedy, in certain instances, the method of spinal anæsthesia; and do not still later reports come to us of venous (Bier) and even of arterial (Goyanes, Ransohoff) anæsthesia? Has not Burkhardt induced general anæsthesia by administering a solution of ether intravenously, with complete success in a series of over thirty cases? Yet who thought, sixty, or even thirty years ago, that there could be an improvement over general anæsthesia by inhalation? And who now will be so bold as to assert that surgery has already reached the end of the possible solutions of this problem? It is, of course, quite probable that not all of these newer methods of administering anæsthetics will prove to be of permanent value; but those surgeons who know what already has been accomplished will not lightly conclude that no further progress will ever be made.

Sepsis and Antisepsis; Asepsis. A problem of perhaps equal import with that of anæsthesia, though not clearly recognized as a problem until shortly before its solution, was that connected with the healing of wounds. Hippocrates had learned the importance of frequently washing the patient with warm water before an operation; and the use of the cautery, of boiling oil, etc., undoubtedly had healing as well as styptic effects. Empiricism, that heaven-inspired, but often much abused habit, taught the mediæval monks that wounds healed more kindly if smeared with balsams; and though such methods were at later dates condemned as "filthy," and though such dressings were described as "stinking messes," the truth was finally brought to light that these dressings possessed in their own feeble way what are now known as "antiseptic properties."

By a similar empiricism, before the period of Listerism, and also after the doctrines of this master began to be bruited about, but before they were generally accepted, it happened that many a practical surgeon learned certain methods of operating, and developed certain habits

of dressing wounds, which showed that he was far in advance of his fellows in the quest for a solution of the problem of the best methods of wound treatment. And it is no wonder that those surgeons who knew that, by the methods they adopted, wounds healed with much less inflammatory reaction than did wounds under the care of their contemporaries—it is no wonder, I say, that these surgeons were slow to adopt Listerism in its earliest and most exaggerated form. It is, I think, a matter worthy of careful attention that though Ollier, the great bone-surgeon of France, reported a mortality of 80 per cent. from excisions of the knee before adopting the antiseptic method, and of only 14 per cent. after its adoption; yet my father could record a mortality of only 8.3 per cent. in a series of eighty-four excisions of the knee-joint which extended through both pre-antiseptic and antiseptic periods; showing that scrupulous cleanliness and the routine use of such virtual antiseptics as turpentine, alcohol, and potassium permanganate, had in his hands very nearly eliminated the mortality due to sepsis.

But great as is the debt which surgery owes to Lister, and to Lucas-Championnière, one of the earliest and most trumpet-voiced advocates of his principles, surgeons were not content to pause in their search for still better methods. Not only have corrosive sublimate and other more acceptable antiseptics largely replaced carbolic acid in surgical practice, owing to the work of Schimmelbusch and Fürbringer; but aseptic methods have been introduced into practice, largely by von Bergmann, while the vast realm of visceral surgery waited for the magic touch of Terrier, who by his persistence in both example and precept, revolutionized hospital equipment in France, and founded a veritable school of aseptic surgery, whose influence has been world-wide, though sometimes too little appreciated.

Hemorrhage. The control of hemorrhage, during, and after operations, is a problem in the solving of which reputations have been made and lost. In Hippocratic times, and during the ascendancy of the Arabian physicians, and their successors the Arabists, the fear of hemorrhage was so great that no cutting operations of importance were attempted. Amputation consisted merely in detaching the gangrenous limb through dead parts; if the bone had not separated the limb was removed at the next lower joint. The teaching of Celsus, that the section should be made through living parts, and that the bone should

be sawed through at a yet higher level, was entirely forgotten in the return to Hippocratic practice induced by the slavish adherence of the Arabian physicians to the Galenic commentaries. In the middle ages, as courage increased, and amputations were again done through living parts, the actual cautery was indispensable to check bleeding from the stump. These cauteries were of various forms and adapted to various uses: some had pointed, and some button or knob-shaped ends, and they were large, middle-sized, and small. Those with the round ends were used for the great vessels; those with the pointed ends for the medullary cavities of the bones; while for cauterizing the remainder of the stump a favorite form was the flat cautery iron, which was pierced by numerous holes, so that the blood and other liquids could pass through, and being thus removed from the face of the stump permit the cautery to come into direct contact with the muscles (Paré). It is no wonder that Petit sarcastically remarked that among the ancient surgeons it was considered a great discovery to invent a new way of burning. The irons must be hot enough, and yet not too hot. If the heat was too great the charred flesh stuck to the cautery, and as the surgeon withdrew the iron the eschar came with it, and bleeding started afresh; on the other hand, if the cautery was not hot enough, its effect was rather to encourage hemorrhage. "A number of cauteries were heated in the fire at once; . . . they were brought from another room, for the surgeons were careful to hide this apparatus. They first struck the cautery against the side of the grate, and then rubbed the face of it upon the floor. They clapped the forefinger upon the mouth of the artery, twisted it (the cautery) round and round, and took a second and third iron when the first cooled. They turned and whirled the cautery thus around upon the mouth of the artery until the blood stopped; and in deep lying arteries they pushed strongly upward, in proportion as they twirled the cautery around, seeking to bury the artery deeper among the flesh. They were careful not to dress the wound until the third or fourth day, lest the eschar should fall off too early. I believe," continues the eloquent John Bell, "that more dexterity, and certainly more hardihood, was required in performing these operations than in using the needle. The horrors of the patient, and his ungovernable cries, the hurry of the operator and his assistants, the sparkling of the irons, and the hissing of the blood

against them, must have made terrible scenes, and surgery must in those days have been a horrid trade."

Is it any wonder that Ambrose Paré said he was inspired of God to use the ligature for the control of bleeding from the face of the stump? He writes (1564) that hitherto he had used the cauteries, because he had seen others use them—"chose très horrible et cruelle seulement à raconter"—but that under such methods only two out of every six amputations recovered (amputation of the leg was almost the only form attempted), and that frequently the soft parts were burned away so far that the charred ends of the bones stuck out, the stump never healed, and a painful ulcer forever prevented the use of an artificial limb. The method he now adopted was to tie a stout cord around the limb, a few inches above the site of proposed amputation, to hold the soft parts up, and to diminish the flow of blood as well as the pain. The bone was divided at the highest possible point after scraping back the periosteum. The blood was then allowed to spurt as long as the patient's condition warranted, to diminish the inflammatory reaction. The vessels were then ligated, being easily found because they were spurting, using a forceps like our modern dressing forceps to draw them out of their sheaths.

Whether it was that the soldiers on whom Paré practised were more robust than the patients of later surgeons, or from whatever reason, it was soon found expedient to omit the bleeding from the face of the stump as part of the routine treatment, and the earliest form of tourniquet, commonly known as the "Spanish windlass," began to be employed in amputations. The ingenuity of LE GRAND Petit, in inventing a form of screw tourniquet which is the prototype of that still in use, has won for him undying fame in the history of surgery; and surgeons would be pleased to forget that he was so carried away by the success of his own devices as to abandon the ligature for *compression* on the face of the stump as a means for permanent control of hemorrhage.

As in other departments of surgery, so in this one of the control of hemorrhage, it long seemed that no improvement could be made over the screw tourniquet; and it was not for considerably over a century after the death of Petit (1750) that Esmarch (1873) introduced his rubber tube, and inaugurated an era of absolutely bloodless surgery. But these bloodless operations by Esmarch's method were confined to the distal parts of the extremities, as it was necessary to leave room between the

area of operation and the trunk for the application of the rubber band. Even amputations at the shoulder and hip joints could not be done bloodlessly. The method of preliminary ligation of the main vessels was unsatisfactory because of recurrent bleeding from their distal ends as the flaps were cut; and digital compression was open to the same objection, as insisted upon by John Bell. There were few surgeons so courageous as Guthrie, who, to convince a pupil of John Bell's that digital pressure alone was sufficient, deliberately turned the face of the stump (shoulder-joint) in his direction, letting off a jet of blood which spattered him from head to foot, and then immediately suppressed the hemorrhage again by pinching the artery between his thumb and finger. Acupressure by passing the pin beneath the main vessels, and compressing them upon it by the thumbs (Hewson), or by an elastic bandage (Trendelenburg), had been tried but abandoned, in spite of the temporary popularity which it enjoyed owing to the prestige and teaching of Sir James Y. Simpson; and it remained for the ingenuity of Wyeth (1890) to combine acupressure and Esmarch's method, and, by the use of steel pins which keep the rubber band from slipping off the shoulder or the hip, to leave the surgeon free to operate bloodlessly and at leisure even close up to the trunk.

But there are rare cases in which even Wyeth's method will not suffice. Take the following case, recorded by John Bell, as an example: a man had received a deep and punctured wound in the buttock, and the profuse bleeding had been controlled by pressure, and the outer wound had closed; but a prodigious tumor formed in the hip, "and from the continual pain and lameness, and from having some hopes of a cure, he was ready to submit to anything, beseeching us to operate." Although it was probable that this was a great aneurism, it was possible that it was a vast abscess; so it was determined to explore it by a small incision, to open it freely if pus were found, but if it proved to be an aneurism to postpone radical operation until after further consultation. As clots were found, which rolled out under very great tension, the wound was stuffed with a tent, and dressed temporarily with a compress, and the patient was put to bed "with one of the pupils holding the hand upon his hip." "This was done at one o'clock, and at four the consultation met, and the operation was performed. And in my notes," says Bell, "I find two steps of the operation chiefly marked: First, that

upon our opening the tumor fully with an incision of eight inches long, and turning out the great clots, the blood was thrown out with a whishing noise, and with such impetus, that the assistants were covered with it, and in a moment twenty hands were about the tumor, and the bag was filled with sponges, and cloths of all kinds, which had no better effect than the cloths which, in any accident, the friends in great confusion wrap round a wounded arm; for though the blood was no longer thrown in a full stream, nor in jets, it was seen rising through the edges of the incision; it floated by the sides of the cloths which were pressed down by the hands of assistants. But we knew also by a more alarming sign that the blood continued to flow, for the man, who was at first lying not flat, but supporting himself on his elbows, fell down, his arms fell lifeless and without pulse over the side of the table, his head hung down, his face was livid, he uttered two or three heavy groans, and we believed him dead.

"Secondly, Seeing, in this critical moment, that if he was to be saved, it was to be only by a sudden stroke, I ran the bistoury upwards and downwards, and at once made my incision two feet in length: I thrust my hand down to the bottom of the tumor, turned off the great sponge which was over the artery, felt the warm jet of blood, put the point of my finger upon the mouth of the artery; then I felt distinctly its pulse, and then only was I assured that the man was still alive. The assistants laid aside the edges of this prodigious sac, and sought out the several smaller sponges which had been thrust in, and the sac being deliberately cleaned, and its edges held aside, I kept the forefinger of my left hand steady upon the artery, passed one of the largest needles around under my forefinger, so as to surround the artery; one of my friends tied the ligature, and then upon lifting the point of my finger, it was distinctly seen that it was the posterior iliac artery—that the artery had been cut fairly across, and had bled with open mouth—that it was cut and tied exactly where it turns over the bone: and, although the extremities were cold, and the man had ceased to groan, and lay as dead; though the faint pulsation could not be felt through the skin, in any part of the body; we saw the artery beating so strongly under my finger, that we were assured of our patient's safety; however, he was so low, that after laying down the sides of the sac, and putting bandages around his body to keep all firm, we were obliged to have a bed brought in, and having given him

some cordials, we left him to sleep in the great operation room, attended by the pupils and the nurses. He passed his urine and feces involuntarily for some days, and was long in recovering his voice." Eventually, however, the cure was complete.

Now in such a case as this, or in cases of sarcomata of the innominate bone, where it is necessary to control the main arterial trunks at a point higher than the brim of the pelvis, Wyeth's method is not sufficient. Nor are aorta compressors or abdominal tourniquets satisfactory; and preliminary ligation of the external or internal iliac artery is open to grave objections. But modern surgery has solved even this problem; for an ingenious German surgeon, named Momburg, has introduced (1908) a method of operating bloodlessly on the pelvis, by wrapping a thick rubber band around the waist, between iliac crests and false ribs, so tightly as to stop pulsation in both femoral arteries; and one year later was able to discuss the results in 34 operations in which this method had been employed with success.

Secondary Hemorrhage. It might be thought that secondary hemorrhage is now no longer an unsolved problem; yet the "Golden Rules" have been learned and forgotten, re-learned and forgotten again, many a time in the last few centuries. Before the days of John Hunter, it was the habitual custom in English surgery, according to Guthrie, for surgeons to tie both ends of a wounded artery *in the wound*. But with the advent of Hunter's operation for aneurism, a much easier operation in many cases, this principle was gradually forgotten; and the adoption of ligation of the main trunk some distance above the seat of the wound, as the routine treatment, soon again made secondary hemorrhage a frequent complication of wounds of the great bloodvessels. It needed all the influence which Guthrie could wield for him to reestablish the principle of ligation of both ends of the wounded artery *in the wound, no matter what the condition of that wound*. French surgeons, in a similar way, were deluded by the popularity of Hunter's operation for aneurism (which they regarded as a revival of that of Anel), into employing it for secondary hemorrhage; absolutely neglecting the principle of ligation of both ends of the wounded artery *in the wound* until convinced of the error of their ways by the teaching of Nélaton.

But as the general adoption of antiseptic methods, and the buried ligature, has rendered secondary hemorrhage one of the rarest compli-

cations, some surgeons are again beginning to forget the principles enunciated by Guthrie. Only last year a case was narrated which reads as if extracted from a case-book of a hundred years or more ago: for secondary hemorrhage from a sloughing wound of the popliteal artery, the surgeon tied the femoral at the apex of Scarpa's triangle (*i. e.*, Hunter's operation); as was to be anticipated, hemorrhage recurred from the establishment of the collateral circulation; the femoral was next ligated just below Poupart's ligament; and when hemorrhage again recurred the limb was amputated in the upper third of the thigh, the patient almost perishing from shock. Guthrie, one hundred years ago, could have foretold this result, so soon as he learned that the surgeon had neglected to ligate both ends of the bleeding artery in the wound.

But time would fail to review, even in the briefest manner, the many problems of surgery which have been solved, and to recall momentarily the various diseases which at one time or another have occupied a large place on the surgical horizon, but which have now sunk almost out of view. Diseases of the joints, which were formerly curable only by amputation, next passed through a stage in which excisions and resections were the order of the day; at present, excision of joints has become one of the rarer operations of surgery, since the general adoption of still more conservative measures has rendered excision for disease seldom necessary; while instead of excision and osteotomy (Adams, Gant) for ankylosis, we are beginning to hear of successful cases of arthroplasty (Murphy, G. G. Davis, Baer), and of transplantation of entire joints (Lexer). In the treatment of dislocations, blind force, with the use of compound pulleys, has been largely replaced by scientific manipulation, systematized in this country by Henry H. Smith, and later revived by Kocher. The use of the bone filling of Mosetig-Moorhof has nearly solved the problem of the great bone cavities formerly left after operations for diffuse osteomyelitis, and *plombage* is succeeding *évidement* as the routine operation for such cases. Empyema, formerly so fatal a disease that when Dupuytren was attacked by it, he refused to be operated on, saying he would rather die by the hands of God than by those of his colleagues—empyema has passed through the stages of simple tapping, of incision, of Estlander's resection of ribs to obliterate the cavity (1877), up to Schede's most extensive operation for the same purpose; and when

even such attempts failed to obliterate the cavity, surgeons turned their attention to the lung itself, and the practices of decortication of the lung (Fowler, Beck, 1893) and discission of the pleura (Ransohoff, 1906) have been introduced, in the effort to make the lung expand; and just now when the problem appeared to have been worked out to the limit in that direction, along comes Ochsner and holds out another ray of hope by means of injections of bismuth paste after the method of Beck; while Murphy claims to prevent the very formation of such cavities by aspiration and injection of formalin-glycerin solution, without drainage of the chest.

The constitutional effects of hemorrhage, once treated by indirect transfusion of defibrinated blood, and of milk, are now successfully combated by the use of saline solutions intravenously; and this is again being replaced in suitable cases by the direct transfusion of blood by the methods of Crile and of Brewer.

Formerly the only form of intra-abdominal disease successfully amenable to surgical treatment was that of localized suppuration. Today, in every great city and in every village, and on every hilltop and in every valley in the country, surgeons are constantly preventing the development of such lesions by removal of the vermiform appendix in the earliest stages of inflammation (Deaver, Morris, Murphy).

In the eighteenth and early nineteenth centuries nearly every wound of the head was trephined; until the abuse became so great, and the deaths so numerous, that Stromeyer was led to say that it was a fortunate thing that it was the inner and not the outer table of the skull that was most splintered, because if surgeons could actually see the damage on the inside in cases of injury apparently trivial, even these slight injuries would be treated by trephining, and patients who might otherwise recover would surely die as a result of the operation. It required many long years of sad experience to convince surgeons that there was no inherent virtue in the trephine itself, and that it was to be employed only as any other instrument to accomplish definite results by mechanical means. Sixty years ago it is said that an American surgeon was ridiculed for opening an accessible brain abscess; to-day small abscesses are opened, and seemingly inaccessible tumors of the brain are frequently removed.

The treatment of aneurism has advanced from the old and dangerous operation of Antyllus, and from high amputation, which was pronounced

by Pott to be the only safe treatment, to the various methods of ligation practised by Hunter, Anel, Brasdor and Wardrop; and by the genius of Matas we are now enabled to look forth on an ever widening field of surgical activity.

Before the middle of the nineteenth century tracheotomy was a rare and an exceedingly fatal operation (Nélaton had the melancholy record of twenty-five operations with twenty-four deaths); after the introduction of antiseptics, however, this operation witnessed its halcyon days, and many an infant was snatched from a painful death by its means; yet today tracheotomy, in this country at least, has become a very rare operation, owing primarily to the introduction of intubation of the larynx (O'Dwyer, 1885), and latterly to the marvellous results of treatment with antitoxin. Yet the time is long from the days of Desault, who first practised a crude form of laryngeal intubation, to the present.

It was a long period from the days of Benedetti, who in 1511 rejected contusion and contrition of stones within the bladder by means of instruments introduced without external incision, to the time of Civiale, who, in 1824, re-invented lithotomy and introduced it to modern surgery; and from Civiale's operation to Bigelow's litholapaxy (1878), was another long stride; but each of these surgeons, in his own way, solved the problem which confronted him, and surgery is forever indebted to their genius.

Nor has it been only the practical side of surgery which has made advances. Though the improvements in methods of treatment and in operative technique are the more conspicuous, the Science of Surgery also has undergone a steady and progressive, if slow, evolution. These changes can be appreciated in no way better than by a consideration of the character of the writings of surgeons at various epochs. Probably the most undeveloped form of instruction consists in the mere narration of cases, without any attempt at grouping the various affections, or inferring principles of diagnosis, prognosis, and treatment from the recurrence of similar phenomena in such groups of cases. This primitive method is well exemplified in the works of Fabricius Hildanus, whose six hundred case histories (six "centuries" of cases) were published in 1646. The *Sepulchretum* of Bonetus (1679), and the *De Sedibus et*

Causis of Morgagni (1761), are works of the same general nature. While no one should despise such publications, since the truth of the motto "*Ars Medica tota est in observationibus*" is well recognized; yet I think it cannot be denied that, as the architect is greater than the artisan, so the tasks of collation, analysis, synthesis, and criticism, imply higher reasoning powers than does the narration of case-histories; and that the works thus produced—systems, or text-books, as they are called—in which the inductive rather than the deductive method is followed, serve better as vehicles of instruction than case-histories alone.

Until the time of Paré the system or text-book, as the term is understood to-day, was practically unknown. The writings of the ancients and of the Arabian physicians might be classed with the modern monograph; but until the seventeenth century no attempt was made to include the entire field of surgery in a single volume, and afford to the student an opportunity to familiarize himself with the relative importance of different lesions and diseases. The surgical text-books of the seventeenth century consisted chiefly of disconnected chapters on such topics as Anatomy, on Tumors (which included abscesses, inflammations, and cancers), and Descriptions of Operations, especially amputations, hernia, hydrocele, and the stone. Such were in subsequent years the works of Fabricius ab Aquapendente, of Wiseman, of Petit, of Heister, of Pott, and of Desault.

Little change is appreciable in the general character of surgical text-books until the advent of John Hunter, who first erected surgical pathology into a science, and by his exposition of inflammation as a process, at once made evident the inter-relation of abscess, ulcer, and gangrene; and by his work made possible the orderly lectures on the principles of surgery of Astley Cooper and of John Bell; while at a later date the systems of Pitha and Billroth, of Holmes, and of Ashhurst, depended for their much more scientific character on the advances in surgical pathology inaugurated by Billroth, Paget, and Gross.

But, though, as I said in beginning this address, it is a pleasure to look back on the past, and to contemplate our position to-day, as the "heirs of all the ages, in the foremost files of time," there is always a danger that we shall be deluded into the thought that surgery is now so excellent that it is useless to seek for further improvements; that the problems have all

been so well solved for us by our predecessors that little remains for us to do; and that we shall look not only with a laudable suspicion on what is new and revolutionary in doctrine or practice, but that we shall greet reforms and reformers with enmity and contempt.

Some of you may remember that in the Seventh Book of the Republic, Plato represents Socrates as likening human life to existence in a sort of underground den, which has a mouth open to the light, and reaching all across the den; the men who inhabit this den have been there from childhood, seated with their backs to the light, and with their limbs and necks so securely chained that they cannot turn around. At a distance above and behind them the light of a fire is blazing, and between the fire and the prisoners there is a raised way, bordered by a low wall, shoulder-high. Other beings pass along this raised way, only their heads and the objects they carry appearing above the wall, and casting grotesque and uncouth shadows on the opposite wall of the cavern; and some of the passengers are talking and some are silent. But the prisoners, chained immovably in the cave, cannot see the realities which pass by outside; they behold only the shadows flickering on the wall before them. But as they have never seen anything but shadows, and have never heard any sound but echoes, they not unnaturally think that the shadows which they see and the echoes which they hear are realities.

And now, suppose that one of these men, who had been chained in this cavern since childhood, should suddenly be released; that he were to totter out of the cavern into the light of day; would not the light pain his eyes, and would not the things he beheld seem to him very unreal? He will require to get accustomed to the sight of the upper world; and when he remembered his old habitation, and the wisdom of the den and his fellow prisoners, do you not suppose that he would felicitate himself on the change, and pity them? And if those in the cave were in the habit of conferring honors on those who were quickest to observe and remember and foretell which of the shadows went before, and which followed after, and which were together, do you think that he would care for such honors and glories, or envy the possessors of them? And suppose that he were to return again to his companions in the underground den, would he not stumble in the dark, and look clumsy, and awkward, and ridiculous? They would say of him that up he went, and down he comes without his eyes; they would regard him as a fool; they would say there

was no use in even thinking of ascending; and if any one tried to loose another and lead him up to the light, let them only catch the offender in the act, and they would put him to death (Jowett).

There have been many similar experiences in surgery. When Guthrie returned in 1814 from the Peninsular campaigns he was consulted by an old man who asked to have his thigh taken out at the hip-joint. Guthrie, who had already done the operation several times, desired, for reasons of professional etiquette, a consultation with the surgeons who had already seen the patient. "Mr. Cline pronounced the operation of amputation to be inadmissible, barbarous, and little less than murder. The second surgeon followed his example, and declared he could not countenance it by being even present. The third, Sir Astley Cooper, said he would assist me, if I would do it."

In spite of Paré's example and insistent teaching, the ligature was not generally adopted for more than a century after his death, and he was called "a bloodthirsty and cruel rascal." (*Tantum religio potuit suadere malorum!*) McDowell's and Atlee's operations of ovariectomy were considered beyond the pale of legitimate surgery. Partial gastrectomy for carcinoma was an operation which not so many years ago made cold chills run down the back of conservative surgeons. Beck says that in 1898 a celebrated Berlin surgeon, speaking to him of the early removal of the appendix, said "Only an American would do such a thing."

It is owing to the genius and the persistence of such pathfinders of surgery, that our art owes its proud position to-day. It is no wonder that the intense light of the new truth dazzles, with its brilliance, eyes long accustomed to darkness, and that it is a positive pain to a surgeon to be forced to abandon theories and practices of whose value he had long been convinced; and when these surgeons have broken their fetters, have found their way up to the light, and have been dazzled with the vision they behold of the surgery of the future, is it a matter of surprise that to those who still sit enchained in darkness the echo of their voices sounds inarticulate, and their gestures of delight as they come stumbling back to us, to bear us the good tidings, appear the fantastic shadow pictures of a puppet show? And if their first attempts to show us what they have seen in the land of vision turn out to be failures, partial or complete, must we therefore condemn these innovations out of hand? Paré contended, "qu'il reste plus de choses à chercher qu'il n'y a de trouvées; qu'il ne

faut pas nous reposer et endormir sur le labeur des anciens, cômme s'ils avoient tout su ou tout dit;" he wished that the ancients "nous servent seulement d'eschauguettes pour voir de plus loin;" and it was these characteristics that above all else distinguished him from the surgical commentators of his day (Malgaigne.)

Finally, turning our eyes for a moment from Plato's den to a lonely cave on the side of Horeb, the mount of God, are there not some who ought to be prophets in Israel, or some who formerly were prophets in Israel, who are now skulking in the cavern of despair, with lost ambition and hope which has been killed? Does there not come to some such the still, small voice which urges them to step forth to the entering in of the cave? And does it not say to each of them: "What doest thou here, Elijah?" Are there not battles now going on in which these ought to bear a part? Are there not victories yet to be won in the warfare of Surgery with Disease, in which their help is needed? Shall they forbear to take a part, however small, in the onward march of Surgical Science, and shall they be cursed with the bitter curse of Meroz, "which came not to the help of the Lord, to the help of the Lord against the mighty?"

To know the wisdom and the accomplishments of the past, and from them to gain a clearer vision of the needs and the possibilities of the future; to record and to study the experiences of the present, and compare them with the learning of others; to recognize the shortcomings and the disadvantages of current methods and theories, and to search for better; to let neither feeble health nor prosperity, neither the indolence of youth nor the procrastination of advancing years deviate them from the path of learning and of progress; to prove all things and hold fast to that which is good: This is the patience of the saints. This is the patience of surgery.

ἴδου μαχαρίζομεν τοὺς ὑπομένοντάς.

Epist. Jacob., v, 11.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING, HELD JANUARY 3, 1910

The President, DR. WILLIAM J. TAYLOR, in the Chair.

COMBINED CYSTOSCOPIC AND RONTGENO-
GRAPHIC EXAMINATION OF THE
KIDNEYS AND URETER.

BY ALEXANDER A. UHLE, M.D., GEORGE E. PFAHLER, M.D.,
WILLIAM H. MACKINNEY, M.D., and ALBERT G.
MILLER, M.D.,

OF PHILADELPHIA.

THERE is no group of organs in which methods of precision in diagnosis are more successfully employed than in surgical conditions of the urinary organs. It is indeed surprising what progress has been made in the diagnosis of surgical affections of the kidney, ureter and bladder. The physician who avails himself of the knowledge obtained from a systematic employment of these methods approaches his work with a more accurate knowledge of the pathological conditions and surgical indications than is obtainable in any other field of abdominal surgery.

The chief methods of precision used in the diagnosis of the surgical affections of these organs are the X-ray, the cystoscope and ureteral catheterization.

The X-ray has its greatest field of usefulness in the diagnosis of calculus of the kidney and ureter. Here there is more than one source of error. In a very small proportion of cases a calculus may exist, and a shadow cannot be discerned; again shadows occurring in the region of the kidney or ureter may be caused by other conditions and consequently be misinterpreted. The shadows which must be differentiated from that of stone are those produced by (1) phleboliths; (2) fecal concretions; (3) enteroliths in the vermiform appendix; (4) calcified costal cartilage; (5) osteoplaques; (6) folds of the intestines; (7) foreign bodies in the intestine (pills, tablets, Murphy button, etc.); (8) calcified arteries; (9) calcified lymphatic glands; (10) bullets or shot in the muscles of the back; (11) prostatic calculi; (12) fingermarks on the plates; (13) developing errors, from an uneven flow of the developer; (14) flaws in the plate; (15) tubercular kidney; (16) calcified myomata; (17) extra-uterine pregnancy; (18) dermoid cyst; (19) calcified ovary; (20) moles on the skin. Shadows are also obtained in hydronephrosis, pyonephrosis, and tumor of the kidney, but a correct interpretation is usually impossible.

Cystoscopic examination frequently reveals pathological changes which are characteristic of ureteral or kidney disease. The character of the bladder mucosa, the presence of ulceration particularly around the orifices of the ureters, the condition of the ureteral openings themselves, whether elevated, depressed, inflamed, oedematous, etc., together with their functioning characteristics, and, finally, the character of the fluid ejected (clear urine, blood or pus) are valuable data which aid in establishing a diagnosis.

Ureteral catheterization will determine an obstruction in the course of the ureter, the urine collected will give information as regards the presence of abnormal elements such as blood or pus. The manner of the flow will determine to some extent the functional activity of the kidney or the presence of residual urine in the pelvis of the kidney, such as occurs in hydronephrosis or pyonephrosis.

While ureteral catheters will determine the presence of an obstruction, it is frequently impossible to establish the nature of the obstruction. The passage of a catheter may be obstructed by a calculus, a fold of mucous membrane or diverticulum within the ureter, a stricture or twist of the ureter or pressure upon the ureter from without. Attempts have been made to determine the presence of stone by the use of wax-tip catheters or catheters fitted with a stylet and stethoscope attachment. These methods are often successfully employed in the female by using the cystoscopic tube, but in the male where more complex instruments are necessary their use is difficult and uncertain. The X-ray furnishes the most reliable information regarding the presence or absence of stone, but occasionally a mistake in interpretation is possible, because of the confusing shadows mentioned above.

It is impossible that any one person can become thoroughly skilled in all methods of examination, and the usual practice of having separate examinations made by the cystoscopist and the Röntgenologist in the diagnosis of surgical conditions of the urinary tract is to be commended, especially as the examination made by one will aid the findings of the other. In many obscure or doubtful cases better results will be obtained by combining the Röntgen examination with ureteral catheterization or exploration, using for this purpose a catheter filled with a substance capable of casting a shadow. To facilitate the examination it is best conducted upon the table of the X-ray laboratory, the picture being taken immediately after the catheters have been introduced.

Catheters suitable for this purpose may be obtained by filling the lumen with bismuth paste, metal stylets or fluids of sufficient density to cast a shadow. Our first examinations were made with catheters filled with 30 per cent. bismuth paste. The ends of the catheters were plugged and the paste allowed to dry in the catheter. Flexible lead wire introduced into a catheter gives a more distinct shadow. Both of these catheters are flexible and can be employed without fear of injuring the walls of the ureter, when gently passed. We later found

that fluid injected into the pelvis of the kidney for renal diagnosis was of sufficient density to cast a shadow not only of the kidney pelvis, but also the ureter. Where a stone is suspected a more distinct picture is obtained with the lead catheter introduced to the point of obstruction. It is not advisable to withdraw the cystoscope during the X-ray examination, especially if the obstruction exists within three or four inches of the ureteral opening, as manipulation of the instrument may displace the catheter. The site of obstruction can be estimated by graduated catheters or by measuring the distance which the catheter must be withdrawn before it emerges at the ureteral orifice.

RADIOGRAPHIC EXAMINATION OF THE INJECTED KIDNEY PELVIS.

Before resorting to this means of examination in the diagnosis of surgical affections of the kidney numerous fluids of different strengths were X-rayed to determine the density of their shadows. The percentages of the fluids were selected in accordance with their physical properties and the strength with which they could be used with safety. Among the solutions employed were emulsion silver iodide 5 per cent., novargan 10 per cent., silver nitrate 1 per cent., collargarum 2 per cent. and 10 per cent., and colloidal silver oxide 5 to 50 per cent. Colloidal silver oxide is a silver salt said to contain 50 per cent. of silver, sold under the name cargentos. This salt in 50 per cent. solution gave the most dense shadow. A further test of this solution was made by injecting it into the ureter and pelvis of the kidney removed at postmortem. Before injecting this salt into the pelvis of the kidney of any patient it was used extensively in urethral and bladder affections and was found nonirritating in 50 per cent. strength. The first two patients examined by this means received an injection of warm 20 per cent. solution of colloidal silver, but the X-ray plates were unsatisfactory as the shadows were too indefinite. All the other patients have received an injection of 50 per cent. strength.

Shows normal pelvis of kidney, injected by colloidal silver. (Post mortem.)

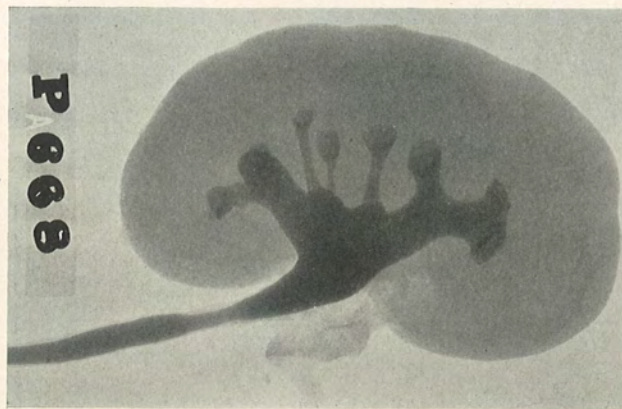


FIG. 1.

Shows some dilatation of the pelvis of the kidney with infiltration of the tubules from a case of chronic interstitial nephritis.—Colloidal silver. (Post mortem.)

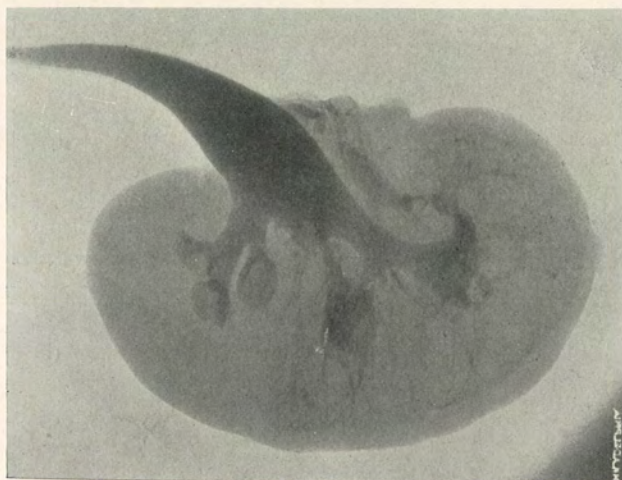
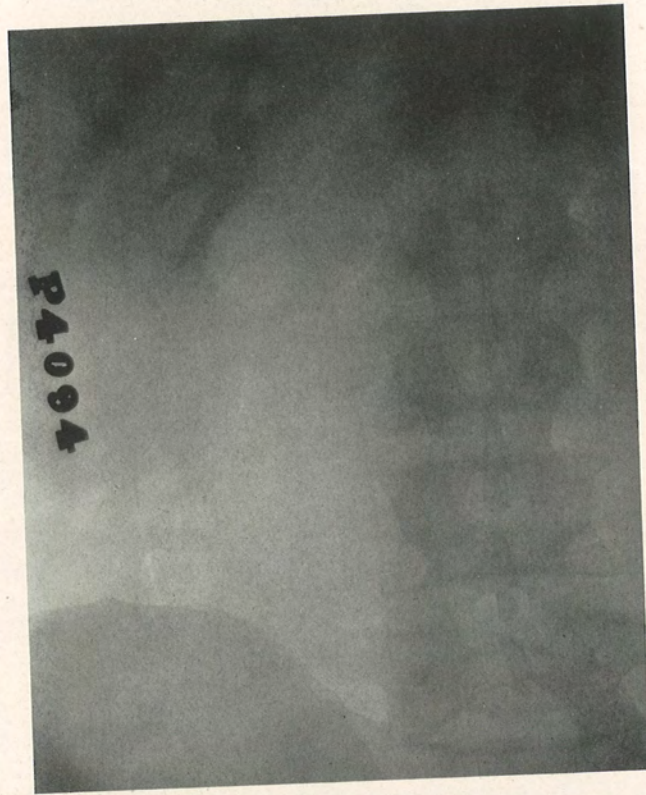


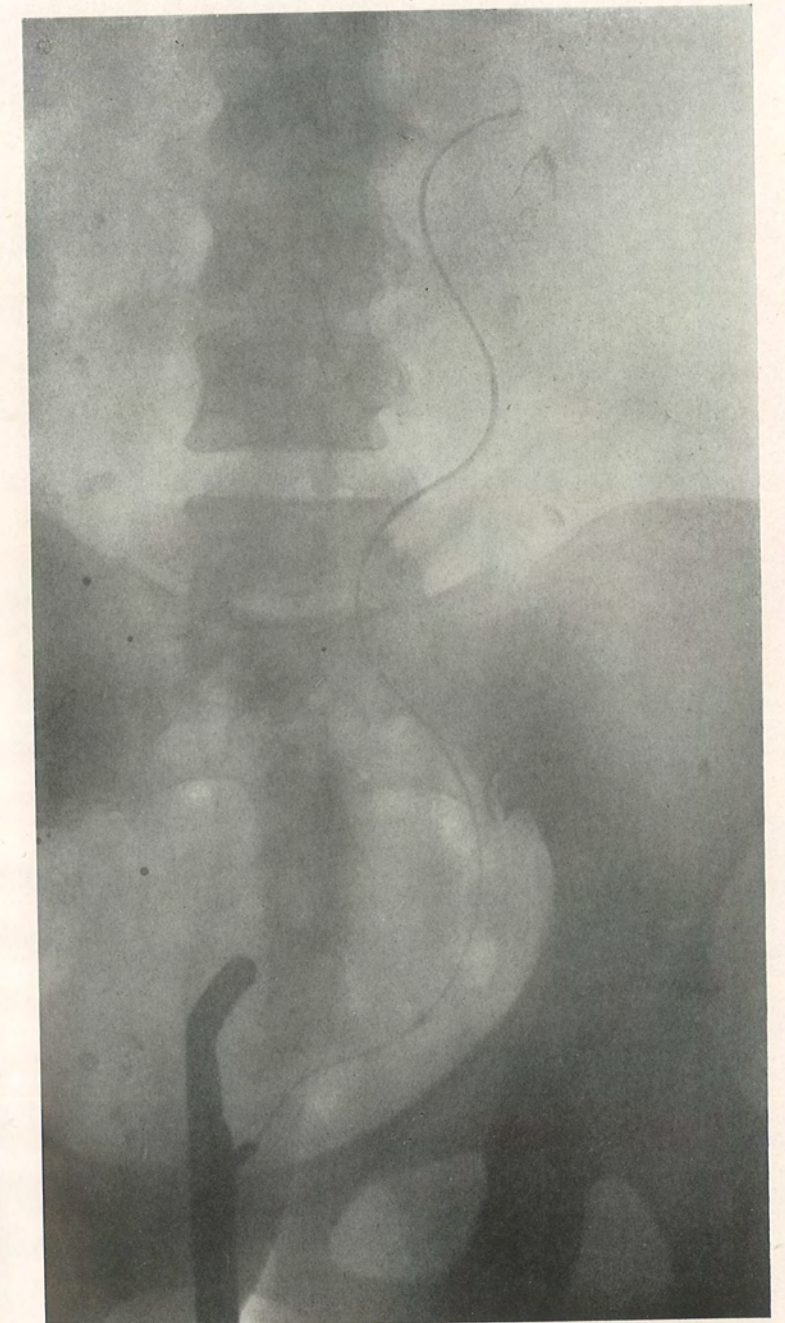
FIG. 2.

FIG. 3.



Shows the normal ureter and pelvis of the kidney injected, in a healthy adult, with colloidal silver (50 per cent. solution).

FIG. 4.



Shows a very tortuous ureter, with a bismuth catheter in position. Shows phleboliths in the pelvis, one lying directly beneath the ureter. (The upper part of the shadow of the catheter has been made more distinct by pencil.)

The solution was injected through an ureteral catheter by means of a syringe of 10 c.c. capacity. Two patients received 10 c.c. each, and the solution flowed back into the bladder alongside the catheter. In these patients probably too much solution was used. The quantity of solution employed was subsequently reduced to 5 c.c., which was found satisfactory from a radiographic point of view. The injections were given slowly so as not to cause sudden distention of the kidney pelvis, a condition which will provoke renal colic. Injections immediately preceded the taking of the X-ray picture. The fluid was allowed to drain from the kidney pelvis before withdrawing the catheter, although subsequent experience has shown that this is not necessary.

Two of the patients who received an injection, suffered immediately from renal colic lasting for several hours after the fluid was injected. Both of those patients were highly neurotic and complained of vague urinary symptoms with pain referred to the kidney region, but in whom no evidence of disease could be found. One of these patients received an injection of 10 c.c. of 20 per cent. colloidal silver, the other 8 c.c. of a 50 per cent. solution into the right kidney pelvis with no discomfort; but a few days later, when the left kidney was injected with 4 c.c. of a 50 per cent. solution colic followed immediately. Later experience has convinced us that the colic is not due to any irritating properties of the solution, but to an overdistention of the kidney pelvis.

It is difficult to estimate the capacity of the kidney pelvis and to know how much of the solution should be injected without causing overdistention. The normal average capacity from our investigations is 4 to 6 c.c., but in pathological conditions it may be less than this or considerably more than even 200 c.c.

To prevent overdistention or the too rapid distention which cannot be controlled with the hand syringe, a difficulty encountered in the first five examinations, we have devised the following technic:

INJECTION OF THE URETERS BY GRAVITY.

The buttocks of the patient are elevated and the ureteral catheter is introduced for a distance of about three inches. The warmed solution is allowed to flow by gravity from a graduated burette, which is connected with the ureteral catheter by means of a rubber tubing to which is attached a small cannula. Then with a force of gravity of about two feet the fluid is allowed to flow. The solution flows at times evenly and at other times intermittently, but finally it comes to a standstill, which is taken as an indication of complete filling of the ureter and pelvis of the kidney.

This technic offers an advantage of a natural filling of the kidney pelvis and obviates the danger of overdistention or too sudden distention. It also gives a possibility of filling a ureter which offers obstruction to the passage of a catheter but in which the obstruction is only partial as is seen by the flow of urine, pus or blood from the ureter before the introduction of the catheter.

By this means we may be able to determine the condition of the ureter, such as dilatation or diverticulation above a partial obstruction, together with the size of the kidney pelvis.

The fluid can then be easily drained from the ureter by the catheter, or it may be allowed to flow into the bladder. An additional quantity of the fluid can then be injected into the bladder and this organ outlined. This is useful in a suspected diverticulation or partial displacement from pressure.

Conclusions that can be made from the examinations thus far conducted are:

1. Combined X-ray examination and ureteral catheterization with catheters filled with substances capable of casting a shadow give more definite information as to the existence of ureteral obstructions than either method alone.

2. Doubtful shadows in the region of the ureters caused by conditions other than calculus can be excluded by this means of examination.

3. By the use of a warm solution of colloidal silver oxide (50 per cent.) a definite shadow of both ureter and kidney pelvis can be obtained.

4. This salt is non-irritating.

5. Renal colic does not occur if the solution is allowed to flow into the renal pelvis under low pressure.

6. Colic is probably due to too rapid injection of fluid or overdistention of the kidney pelvis.

7. This method of examination determines the size of the kidney pelvis, the amount of destruction of the kidney substance and the position of the kidney in its relation to other structures.

8. It also determines the position and alterations in the size and shape of the ureter and the bladder.

DR. PFAHLER remarked that although it is generally supposed that the diagnosis of ureteral or urinary calculi is comparatively simple; this is not the case. There are a great many confusing shadows. In at least half the cases the plates must be repeated to be sure of what has been found. Ordinarily, when they are repeated, one can be sure; occasionally, however, shadows still occur that are almost impossible to diagnose positively, although here, as in every line of work, experience comes into play.

DR. FRANCIS T. STEWART said that he had recently been pursuing a similar line of inquiry, using leaded catheters and collargol 2 per cent. In his series of cases the capacity of the pelvis of the kidney ranged from 3 to 18 c.c. It seems that if one gets an adventitious X-ray shadow, one can be almost sure with these methods of examination whether it is or is not a urinary calculus, but frequently the shadows of calculi do not show on plates. In four instances at least he had been able to recover a stone from the ureter, usually by oil injections, in cases in which the stone did not show on the plates. Phleboliths may often be felt through the vagina or rectum. A few years ago he showed before the Academy some X-ray plates of phantom ureteral calculi. As to the dangers of ureteral catheterization he feels that he should not keep silent, in view particularly of a case which he recently examined for Dr. Mitchell. After catheterization this patient had absolute anuria for a day and a half; at the

end of that time urine was again secreted and the patient recovered, but for a time it looked as if the result might be fatal.

DR. JOHN B. DEEVER said that there was no doubt that in a certain class of cases calculi cannot be diagnosed by the X-ray alone, and all must see the importance of the introduction of the catheter and the X-ray taken under these circumstances. The question of the risk attached to distending the pelvis of the kidney will become less as one becomes more expert in manipulation of the catheter. He called attention to one case which Dr. Pfahler had shown in which a stone was removed from the ureter extraperitoneally at a time when a hysterectomy was done for fibroid uterus; the patient made a good recovery. That case would probably not have come to operation for ureteral calculus had not the diagnosis been made by the X-ray and verified by catheterization.

DR. ORVILLE HORWITZ said that he had had one experience in which the injection of silver solution employed by Dr. Uhle caused anuria, which persisted for about twenty-four hours, causing great anxiety. He had never seen suppression of urine following a simple catheterization, although he was aware that this complication had been encountered by other observers. All had had the experience of passing a catheter past a partial obstruction caused by impacted stone. When this condition persists a diagnosis of stricture is usually made until Röntgenographic examination reveals the presence of calculus. It may not be uninteresting to call attention to the fact that ureteral catheterization or Röntgenographic examination may give wrong information, thus leading to a mistake in diagnosis. In a certain proportion of cases, no matter how skilfully or gently the catheter may be manipulated, the examination causes a hemorrhage which makes it very difficult to determine whether the blood in the urine is due to traumatism or to a pathological cause.

Dr. Uhle has pointed out that when an X-ray picture reveals a shadow alongside, or in the course, of the ureter it is frequently difficult to decide whether it is a phlebolith or calculus. He had an experience of this kind once with a patient who had a calculus causing an obstruction of the ureter located at the brim of the pelvis. It was with difficulty that the catheter could be made to pass the co-arcion; the Röntgenographic examination was negative. Believing that the obstruction was caused by stricture, an

exploratory examination was performed which resulted in quite a large urate stone being removed from the ureter. It is now well known that this rare form of calculus does not throw a shadow and consequently an X-ray picture in such cases is negative.

DR. ALEXANDER UHLE (in closing) said that, in regard to the dangers in the passage of the catheter, he had seen anuria on numerous occasions follow the passage of the catheter alone. In none of the cases he had observed was there any vomiting or any apprehension about the patient's condition. After allowing catheters to lie *in situ*, the kidneys, at times, fail to act for two or three hours, and the passage of a catheter through the ureter will occasionally cause hemorrhage even under normal conditions. A catheter left for any length of time in the ureter will cause some bleeding, not observable in the urine, but cystoscopic examination made two or three days later will show a small blood clot coming from the ureteral opening. This is ordinarily mistaken for tumor, and on two or three occasions the patients have been catheterized later and tumor suspected. Even normal patients used for experimental purposes will show slight hemorrhage.

In regard to diseased kidneys with symptoms all referred to the bladder, he had observed such cases. In tuberculosis the patient may complain of only frequent urination, all symptoms pointing to the bladder, but cystoscopic examination will show the bladder apparently normal.

DR. PFAHLER added, in answer to the question of traumatism, that by the gravity method of injection one can fill the ureter and pelvis of the kidney by passing the catheter only a few inches into the ureter, which is a distinct advantage. He thought this method to be limited in its field of usefulness. The great majority of calculi can be diagnosed without this, and if so there is no necessity for taking any additional risk; it is only occasionally that one wishes to be more certain regarding calculi at the lower end of the ureter. One which came nearest to misleading him was a mole on the patient's back. This patient had persistent hæmaturia; he could find no stone in the kidney, but after repeated X-ray examinations he found a beautiful shadow of what seemed to be a stone about half an inch above the upper pole and lying to the outer side. When the patient was on the operating table, however, he saw there was a mole on the back in just this location, and so told the operator, who however decided to go on with the operation, but no stone was found, and no cause for the hæmaturia yet the patient recovered.

PLASTIC OPERATION FOR THE RELIEF OF AN
INCURVATION OF THE PENIS.

BY ORVILLE HORWITZ, M.D.,
OF PHILADELPHIA.

Professor of Genito-Urinary Surgery in the Jefferson Medical College; Surgeon to the
Jefferson Hospital, and to the Pennsylvania State Hospital for the Insane.

THE case here cited is unique; hence it is believed that a
brief description will not prove uninteresting.

The patient, a man thirty-six years of age, consulted me in
March of the past year for a physical defect of ten years' stand-
ing that followed an operation performed for stricture of the
urethra. His recovery from the operation had been uneventful,
but it was soon after observed that when the organ became erect,
it was bent at almost a right angle in the median line, and was
deflected toward the right side. The deformity made coition im-
possible. Previous to consulting me he had undergone various
treatments at the hands of numerous physicians, but had obtained
no relief.

On inspection, the flaccid penis presented a normal appearance.
Palpation revealed the presence of a fibrous mass, one and one-
half inches long, situated on the under surface of the penis, at
the right side of the urethra. The mass appeared to lie between
the sheaths of the corpus cavernosum and corpus spongiosum,
and to be attached to the lateral wall of the canal. On introducing
a bougie the tube was found to be free from obstruction. The
position and attachment of the cicatricial tissue made it evident
that it could be resected with little or no damage to the body
of the organ; hence a plastic operation, which would, in all proba-
bility, result in benefit, if not in cure, was deemed justifiable.
My colleague, Dr. Loux, who saw the case in consultation, agreed
with my conclusions.

The patient was told that his only hope of obtaining relief
lay in an operation that would be experimental in character. He
was further assured that if it was found that the fibrous mass

could not be removed, nothing would be done, but that if we found
the conditions favorable, we would proceed with the resection.
We impressed upon him the fact that we could promise nothing;
that the operation might fail, or might even result in accentuating
the deformity. On the other hand, it was explained to him that
if the operation proved successful, the result would be most grati-
fying, and the several functions of the organ would be com-
pletely restored.

The patient, an unusually intelligent man, agreed to have an
operation performed.

At operation our previous views were confirmed, namely, that
the fibrous tissue was interposed between the corpus cavernosum
and corpus spongiosum. It was easily resected until the middle
of the penile urethra was reached, this being the site at which
the stricture had been incised. At this point the scar-tissue
formed a part of the urethral canal. Its dissection necessarily
resulted in a hole, about the size of the finger-nail, being left
in the lateral wall of the urethra. In excising the fibrous tissue
in the cavernous structure an incision was made through the
sheath; an upper and a lower flap were then formed, thus giving
access to the scar-tissue, which, fortunately, involved the body of
the organ to only a slight degree, and was easily removed. The
lower flap of the sheath of the corpus cavernosum was utilized
to close the opening made in the wall of the urethra. The wound
was then closed in the usual manner, and perineal drainage estab-
lished by means of a perineal cystotomy.

Following the operation there was cedema of the penis, which
persisted for about four days. The sutures and perineal drain
were removed on the eighth day, when the patient left the hos-
pital. When I saw him, about a week later, he stated that when
the organ became turgid, the former curve in the median line had
almost entirely disappeared, and that there was some slight deflec-
tion of the glans penis toward the right side. A month later
coition was successfully effected.

In 1898 Otis, of New York, published a valuable contri-
bution to the literature on the subject of stricture of the male
urethra. In this work ("Stricture of the Male Urethra and
its Radical Cure") he practically assumes that the urethra
should be of "uniform calibre," at least as far down as the

triangular ligament. He states (*loc. cit.*, p. 22), moreover, that: "We may hence affirm, as a most important axiom, that the slightest encroachment upon the calibre of the urethral canal is sufficient to perpetuate a urethral discharge, or even, under favoring conditions, to establish it de novo, without venereal contact."

These views were received with favor by most surgeons, and thus dilating internal urethrotomy became the accepted method of treating cases of chronic anterior urethritis in whom the slightest suspicion of a coarctation of the urethra existed.

Otis also devised an ingenious instrument, known as a "urethrometer," which serves to determine the dilatability, location, and calibre of any constriction that may be present in the anterior urethra. This instrument is at present used only in the examination of certain obscure cases. In the hands of a surgeon of wide experience in urethral cases, and of one skilled in the manipulation of urethral instruments, the urethrometer is capable of disclosing valuable information. In the hands of those of limited experience in urethral work, however, it is unreliable, and may impart information from which erroneous conclusions regarding the existing local condition of the urethra may be drawn, and a mistaken diagnosis made; thus the patient may be subjected to a urethrotomy that was not only unnecessary, but probably injurious as well.

Many years ago Gross, in his "System of Surgery," emphasized the fact that but few physicians can manipulate urethral instruments skilfully. This writer goes on to say: "To be successful, it requires skill of the highest order and an intimate knowledge of the anatomy of the urethra. My conviction is, but few men can do it well."

It is now well understood that the calibre of the urethra is not uniform, but that the tube is made up of a series of physiologic dilatations and contractions. Its walls are in contact, except during the passage of urine or the emission of semen, or when the canal is distended by the introduction of instruments or other foreign bodies.

In reality, the urethra is a narrow slit, about eight and one-half inches long, the calibre of which is not fixed, but which, when normal, is capable of great distention, without consequent injury. The extent to which the canal can be dilated with safety varies in different individuals. Many years ago Otis demonstrated that the normal dilatability of the urethra bears practically a constant relation to the circumference of the flaccid penis at the penoscrotal junction.

When operating for the relief of a stricture, the surgeon is not concerned about the calibre of the canal, but aims to restore the normal function of dilatation and contraction to the tube, which function is always interfered with when a stricture exists. This result can be attained only by exercising care when dividing the constricting fibrous tissue that makes up the stricture, and by avoiding, so far as possible, inflicting injury to the healthy tissue in front of, behind, and surrounding the coarctation. If the healthy tissue surrounding the constriction is extensively incised, it will be found, on convalescence, that the normal power of contractibility and dilatability of this portion of the tube is permanently lost, and that a plastic exudate forms in the wounded healthy tissue and may become organized into fibrous tissue, which, in turn, contracts, causing an incurvation of the penis.

In the case previously cited, the instrument that caused the incurvation of the penis was one devised by Otis, and known as the "dilating internal urethrotome." The technic of the method of using this instrument is thus described by the inventor: "The normal dilatability of the urethra is first determined by means of the urethrometer. The urethrotome is then introduced beyond the stricture, and the blade separated up to one or two millimetres beyond the normal calibre of the urethra, in order to make the stricture completely salient; the blade of the instrument is then drawn through the entire mass of cicatricial tissue, severing the stricture completely" (Morrow, "Genito-Urinary Diseases," vol. i, p. 308).

The wide employment of this method of performing urethrotomy resulted in quite a large number of incurvations being

reported as a late sequel to this operation. My own unfortunate experience with two patients, coupled with the fact that incurvation of the penis was not an unusual complication of a dilating internal urethrotomy, led me to investigate, and finally to discover, the cause of this untoward result. This I found to be due to overdistention of the urethra when the stricture was incised. On performing the operation with the canal overdistended it was impossible, in some cases, to avoid wounding the surrounding healthy tissue, which, as has previously been pointed out, will cause the formation of cicatricial tissue and result in incurvation of the organ.

Since discovering the cause of this condition I have modified the method of using the Otis dilating urethrotome. The method as now employed by me is as follows: After the instrument has passed slightly beyond the stricture, the blades of the instrument are separated just widely enough to fill the calibre of the stricture comfortably, and not to overdistend the canal, so causing the stricture to become fixed and present an unyielding surface to the passage of the knife. Since adopting this technic I have used this instrument in a large number of cases without subsequent development of untoward results, and I have come to regard this form of urethrotome as one of the most satisfactory and reliable instruments that can be employed for performing internal urethrotomy.

The surgeon engaged in genito-urinary work has long since learned that a chronic anterior urethritis, associated with a stricture of large calibre, in the so-called recent or "succulent stage," is frequently associated with peri-urethral thickening, due to cell proliferation, that interferes materially with the dilatability of the urethra. In such cases he has discovered that better results are obtained by gradual dilatation, employing the conical steel bougie for this purpose, than by attempting urethrotomy.

The once highly lauded and popular method of treating such cases by internal urethrotomy has long since been abandoned, and, in consequence, incurvation of the penis resulting from this method of treatment is now but seldom encountered.

In concluding, let me warn the surgeon not to be carried away by the gratifying result that I was fortunate enough to obtain in the case cited, that he be not led to operate indiscriminately upon cases of this kind that may come under his care. In the past fifteen years I have seen several similar cases, but only in the one just recounted have I deemed operation justifiable. In the others the scar tissue was so extensively connected with the penile urethra and the corpus cavernosum that an extensive resection of the fibrous mass would have resulted in a hopeless mutilation of the body of the organ.

DR. JOHN B. DEEVER agreed with Dr. Horwitz that the Otis dilating urethrotome is a dangerous instrument if not used judiciously. He recalled one case of a doctor with a slight incurvation following an internal urethrotomy which he performed, and after this he was very cautious in the use of this instrument. He had seen slight incurvation a number of times occurring in the practice of others, but never any reaching the degree of Dr. Horwitz's case. The incurvation, though very slight, in a nervous man is enough to make him very uncomfortable.

The modification which Dr. Horwitz suggests is most important—that is, not to overdilate when the blade is drawn through the stricture. This is particularly important advice for young surgeons who are about to take up the Otis instrument.

THE TREATMENT OF SYPHILIS BY HYPODERMIC
INJECTIONS OF SALICYLATE OF MERCURY.

BY MACY BROOKS, M.D.,
OF PHILADELPHIA.

IN treating syphilis we are confronted with two great difficulties: First, to keep the patient from blowing his brains out when informed of the nature of his malady; and, second, a much more difficult task, to keep him on regular treatment after all the subjective symptoms have disappeared and he is apparently perfectly well.

Is there any wonder that the dispensary and hospital cases proclaim themselves cured and throw away their medicine, when the refined and educated gentleman grows lax, indifferent and intermittent in his treatment and often goes so far as to marry contrary to advice, after a year or a year and a half of spasmodic medication.

Any method which by its prompt and rapid relief of all acute secondary symptoms, and by the fact that it makes it necessary for the patient to see the physician every five or ten days, is bound to impress the syphilitic with the importance of the disease and the necessity of regular treatment.

Few patients will make visits daily or every second day, as is necessary with the soluble salts, unless there is some subjective symptom which is worrying them, but the majority prefer to receive a hypodermic every five to ten days, as is required in this treatment, to taking medicine three or four times daily for several years, in constant dread of detection, or to rubbing in inunctions for twenty minutes once or twice daily and having their clothing and bed linen stained continuously.

The injection of the insoluble salicylate of mercury, if performed, as will be explained, is practically a painless pro-

cedure. There is established a medical depot which is continuously dispensing mercury day and night as the tissues gradually change the insoluble salt into a soluble mercury.

The physician cannot be misled as to the amount of mercury the patient is getting and the patient cannot become lax in his treatment without the physician knowing it.

I was surprised when I first started this method of treatment to find how pleased were all my private patients, who had previously been on pills, to take it up and continue it.

The injections are continued all through the treatment even after the iodide has been started.

I believe from what I have seen of this treatment in my own practice and in the wards of the Philadelphia Hospital, that it is far superior to any, except inunctions in the hands of an experienced masseur, which is not practical in the vast majority of cases.

The rash, the headache, the angina, the osteocopic pains, the mucous patch, the alopecia and the condylomata rapidly disappear, and are seldom seen again if this treatment is continued. There have been no relapses in any of my private cases.

The solution which is used is composed of mercury salicylate, Mercks, 1 part, liquid albolene, 5 parts. One minim of this solution will equal one-fifth of a grain of mercury. This solution may be placed in one ounce bottles which are corked with sterile cotton, and placed in a water bath, the temperature gradually being raised to the boiling point and kept there for an hour. These bottles may then be corked with sterile corks, the necks dipped in paraffine, ready to open when needed. After once being sterilized the solution appears to remain so.

Dr. Gottheil told me he had left a bottle of this solution uncorked in his office for several months and after repeated attempts the bacteriologists had been unable to grow a culture from the exposed top of the media.

Liquid albolene will not become rancid, as will the vegetable oils and it is in no way irritating. It passes readily through

the needle, yet is heavy enough to hold the mercury in suspension for several minutes. It is unaltered by the regular means of sterilization.

It is advisable to have a special syringe having a long narrow barrel, so that the markings indicating minims are not too close together. With an oily menstruum it is difficult to measure a minim accurately in an ordinary closely marked hypodermic. All parts of the syringe, other than the barrel, should be of metal, so that it shall be as heavy as possible, to facilitate a quick deep puncture with the long needle. The needles vary in length from an inch and a half to an inch and three-quarters, depending upon the thickness of the patient's buttocks. The needles should be made to slip on to the syringe, instead of screwing on, so that the barrel of the syringe may be readily disconnected from the needle without disturbing the point, as is apt to occur when the barrel has to be unscrewed. The needle must have a larger lumen than the ordinary hypodermic needle to permit the passage of an oily fluid; a separate needle is kept for each patient.

The salicylate of mercury has no action on metal except to preserve its lustre and prevent oxydizing.

The best syringe is one designed by Dr. Gottheil; it has a plain metal piston which completely fills the barrel of the syringe, leaving no dead space when at the end of its stroke. The thumb end of the piston terminates in a flattened disk large enough to support the syringe with needle attached in a perpendicular position, so that no contamination may take place after sterilization.

The technic of the injections is very simple. After the syringe has once been sterilized the film of mercury which remains in the barrel keeps it sterile. The needle end of the syringe is wiped off with ether on cotton; it is then passed back and forth through the flame of a spirit lamp, five or six times, so that the solution may not be contaminated. It is now filled with the salicylate of mercury solution, which has previously been well shaken, and the needle being fitted in place is drawn through the flame several times. Care must

be taken not to heat the needle hot enough to take the temper out of it.

The syringe now being filled and all air expelled, is ready for use. The patient stands in front of the operator in the position of "attention," feet together, body erect and with buttocks relaxed. The skin is sterilized with a pledget of cotton wet with ether. This also chills the skin and renders it anæsthetic. This anæsthesia may be increased by blowing upon the ether-moistened skin. When the skin is quite cold the needle is driven home with a rapid stroke into the fullest part of the buttock on a line perpendicular to the intergluteal fold and one inch to one and one-half inch external to it.

The syringe is disconnected and the end of the needle watched for twenty seconds. Should the injection fluid start to well out, the needle is in a small vein; where the vein is large the fluid is followed by drops of blood. In either event the needle must be withdrawn and re-inserted. This may be done immediately, or, should the patient be nervous, it may be postponed. When the needle is found to be properly inserted, the barrel is again attached and the injection fluid slowly introduced. The needle is then rapidly withdrawn, its track closed by rotating the tissues with a pledget of cotton. A square of sterile zinc oxide adhesive plaster is placed over the point of puncture. This may be removed in a few hours. Blood from the seat of puncture after withdrawal of the needle is of no consequence, simply indicating that a vein has been injured as the needle passed it; pressure for a moment will stop this. With this form of treatment, there is less tendency to salivation and gastro-intestinal disturbances, and the results are very rapid.

In ordinary cases, the headache, rash, and sore throat disappear after the first or second injection, and persistent cases are frequently relieved after three or four hypodermics.

It is well to start with a small dose at first, especially in women, except when there is a severe lesion requiring drastic measures.

In starting the treatment at the Philadelphia Hospital,

there were a number of cases which had been under other treatment for various periods, ranging from a month to eight months, some of which had been very refractory, having stubborn mucous patches and condylomata; most of these cleared up after two or three injections.

I have collected data on sixty cases, which I will not report here, except to state that they indicate a decided improvement over the methods previously used at the hospital.

Dr. Christian and I started this treatment last winter at the Philadelphia Hospital and the other chiefs upon the genito-urinary service have continued it as the routine treatment ever since, which would indicate that they were pleased with their results.

The advantages of this form of treatment are as follows:

All treatment is administered by the physician, therefore he can readily determine when a patient is neglecting treatment.

The history shows the exact amount of mercury the patient is getting, which is very important in determining results, as few patients are regular with treatment by mouth or inunctions.

A visit every five to ten days to a doctor's office does not arouse suspicion, and it relieves the man of affairs from the fear of detection in constantly taking medicine and the danger of forgetting it.

Simplicity of technic—flaming, instead of boiling, being all that is required.

The injection, if properly given, is practically painless, causing a slight bruised sensation which usually disappears in twenty-four hours.

These points of advantage, coupled with the fact that this method seems to give the most rapid results, even in very stubborn cases, should recommend it to those who have not yet used it.

DR. HILARY CHRISTIAN said that he had been all his life a most uncompromising opponent to the hypodermic treatment of syphilis, for the reason that he had always felt that the introduc-

tion of the drug in this manner rose to the dignity of an operation, involving the risk of abscess, considerable pain, and the danger of acute salivation, but he had had lately an open mind on the subject owing to the experience he had had in his service at the Philadelphia Hospital, and he had come to believe almost that the hypodermic treatment of an insoluble salt of mercury is superior to any form of internal treatment, although he had never had any fault to find with internal treatment except when the patient got beyond control and run away. He had seen in the wards of the Philadelphia Hospital such great results that he was compelled to come to the conclusion that there is probably a great future for the treatment of syphilis by the hypodermic introduction of an insoluble salt. This salicylate of mercury used by Dr. Gottheil for ten years persistently with few if any abscesses and with absolute disappearance of all lesions, is entitled to some belief and respect.

DR. JOHN B. ROBERTS said that he had had a little experience recently with the hypodermic use of mercury in a case of tertiary syphilis. The patient has specific osteoperiostitis of the tibia, and was treated by him with inunctions of mercury, and mercuric chloride with potassium iodide internally in enormous doses by the mouth for seven years. Several operations for splitting the periosteum and boring into the bone were done. The pain was alleviated but not entirely relieved. Recently he had been giving her succinimid of mercury, one-fifth grain, hypodermatically once a week, and it is astonishing how quickly she had been relieved of her pain, and how little discomfort she has as compared with that resulting from the other treatments given by mouth.

DR. THOMAS R. NELSON said that he had been very much impressed by the results in one or two precocious cases of syphilis in which mercury given by the mouth was not efficacious, but he would not like to subscribe to the routine treatment of syphilis by the hypodermic injection of mercury, the risk hardly seeming worth while. However, it is valuable to have such treatment when the introduction of the drug by way of the stomach does not prove of value.

DR. ORVILLE HORWITZ said that at the present time most of the syphilographers are in accord in teaching that syphilis is best treated by administering a course of mercury for at least two and one-half years. Mercury should be given for a short period

by mouth. This method should be interrupted every four to six weeks and either hypodermatic medication or inunctions substituted for about two weeks; which course is to be pursued during the entire time that the patient is under observation.

On return from a visit from the various venereal clinics in Europe in 1883 he found that hypodermatic medication and inunctions of mercury were relied upon as the standard method of treating the disease in determining the secondary or tertiary stage. He decided to investigate the hypodermatic method and after the study of one hundred and thirty (130) cases he read a paper giving the results of his observations before The County Medical Society which was afterwards published in the *Therapeutic Gazette* of May 19, 1894. The discussion of the paper gave rise to a most acrimonious discussion, and when the Society adjourned the majority dispersed believing that this method of treatment was dangerous, unsatisfactory, and one to be employed only in specially selected emergency cases. Not discouraged by this adverse view of his confrères he had continued to employ the hypodermatic method as a means of treating syphilis for the past twenty-six years and was fully convinced that when properly employed it is one of the strongest and most reliable weapons possessed by the physician wherewith to fight this disease.

It is gratifying to find that the hypodermatic treatment of syphilis is rapidly becoming the standard method employed as a routine treatment by all progressive physicians.

DR. BROOKS, in closing the discussion, said that the dangers of this method are very slight. Embolism cannot occur if the operator takes sufficient time to be sure that the needle is not in a vein.

The danger of abscess is very slight, if the technic is carefully carried out and the injections given deeply. Dr. Gottheil claims to have only had one abscess in ten years and that happened in the case of a patient treated in a dirty tenement without aseptic precautions.

A few deaths have occurred after the hypodermic injection of mercurial salts, but these are extremely rare, and it has not been proven that death was due to the fact that the drug was administered by hypodermic,—some patients have a rare idiosyncrasy for mercury and cases are reported where death has followed its administration by mouth.

Administration by mouth is very uncertain, even when the patient takes his medicine regularly, for the pills are often so old and hard that they pass through the alimentary canal undissolved.

DILATATION OF THE PROSTATIC URETHRA FOR THE RELIEF OF THE SYMPTOMS OF PROSTATIC ENLARGEMENT.

DR. E. HOLLINGSWORTH SITER said that the Bottini operation having been practically discarded, the only procedure left for the relief of the prostatic symptoms is prostatectomy. But there are so many cases that are not fit for the prolonged anæsthesia and shock of prostatectomy, that it seems some method should be devised for this class of patients.

Three and a half years ago, a patient upon whom he proposed to do a suprapubic prostatectomy did not do well with his ether after he had opened his bladder, and he was led to try dilatation of his prostatic urethra with his finger. The results were so gratifying that he had since employed it frequently. This patient's urinary difficulties disappeared, and he heard from him recently that he had had no return of frequency and was not rising at night. His age was 65 years and owing to the fact that there had been no disturbance or injury of his ejaculatory ducts and vesicles, he had had no interruption to his sexual life.

He had since employed this procedure on some twenty cases and his results had so far been satisfactory in every way, not only as to relief of symptoms, but as to uninterrupted sexual life and no return of urinary disturbances.

The cases he had selected have been the "spread out" prostates, usually with cystitis and always somewhat run down from the effects of catheter life. He had tried it on two hard prostates but too recently (within eighteen months) to say how long the relief will last.

He had also tried combined removal of the "middle" lobe and dilatation, but these have also been too recent to estimate the permanency. He felt that this method was worth a long and continued trial. It can be employed under local anæsthesia as it is no more than a suprapubic cystotomy. There is no loss of blood, practically no shock, and the patient can be up and about in a few days. Where there is cystitis, he drains the bladder for two or three days suprapubically. Where there is no cystitis, he

closes the suprapubic wound and drains through a catheter left in the urethra. The after treatment has consisted of a daily irrigation for ten days or two weeks, with urinary antiseptics by the mouth.

He thought dilatation had the following points to recommend it,—absence of shock, absence of interruption to sexual life, brevity of the operation, absence of secondary hemorrhage, quickness of recovery and absence of post-operative incontinence; and the fact that the operation can be done without waiting for the disappearance of a long continued and troublesome cystitis due to the catheter life so many prostatitis lead before they come to operation.

Then again, the operation is so simple and safe that he would not hesitate to repeat in a few years or every few years, if there is no permanency to the relief, and there is a return of symptoms.

DR. JOHN B. ROBERTS said, before prostatectomy was known to be so successful and satisfactory much relief was given in some cases of moderate prostatic enlargement by the use of large bougies introduced through the urethra into the bladder. Retrograde dilatation through a suprapubic incision ought to be even more valuable and Dr. Siter's remarks indicate its beneficial effect.

HYDATID CYST OF THE LIVER.

DR. FRANCIS T. STEWART related the history of a man, aged 19 years, who was admitted to the Pennsylvania Hospital August 25, 1909. For one year he had been suffering with epigastric pain, indigestion, and occasional attacks of vomiting; he had lost much weight. On admission he was extremely ill. The temperature was 105° F., the pulse rapid, the skin moderately jaundiced, and the mind clouded. A large mass could be felt and seen in the right hypochondrium, and above this a secondary nodule close beneath the ribs. The mass was dull on percussion, extremely hard, and moved with respiration; neither fluctuation nor fremitus could be demonstrated. The leucocytes were 15,000; the urine bile stained, turbid, acid, with a S.G. of 1011, a cloud of albumin, and a few granular casts. As he had seen two somewhat similar cases, which, on exploration, proved to be sarcoma of the liver, he made this diagnosis, and suggested exploration with the hope that he was wrong and that some condition amenable to surgical treatment would be found. In two days the temperature fell to

normal and the patient was much improved. The abdomen was then opened and a hard, whitish mass protruding from the convex surface of the liver disclosed. The secondary nodule previously mentioned was about one inch in diameter and not connected with the larger mass; it was excised to corroborate the diagnosis, but on incision was found to be a cyst with a white lining and clear contents. The larger growth was then punctured; and finally incised; it had an extremely hard and thick wall lined with a softer layer, and contained about two quarts of fluid and white, spherical, daughter cysts, ranging in size from a pea to a hen's egg. Scolices, hooklets, and cholesterol crystals were found in the fluid. The mother cyst occupied the right lobe of the liver and was about 10 inches longitudinally and 8 inches transversely; it was enucleated and the cavity painted with iodine, sutured to the abdominal wall, and packed with gauze. A large quantity of bile subsequently flowed from the wound, but the cavity rapidly contracted and healing was complete in nine weeks.

STATED MEETING, FEBRUARY 7, 1910

The President, DR. ROBERT G. LECONTE, in the Chair.

GUNSHOT WOUND OF KNEE JOINT.

DR. ASTLEY P. C. ASHHURST related the history of a girl, aged 16 years, who while sitting on her front porch one afternoon felt a sudden pain in her right knee and found she had been shot; no explosion was noticed. She walked at once to the Episcopal Hospital, a few squares distant, and was admitted to the service of Dr. Frazier (October 17, 1908), to whom Dr. Ashhurst is indebted for the privilege of operating.

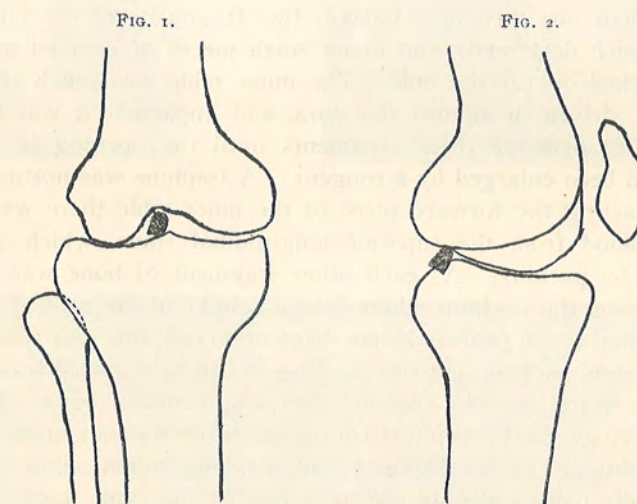
Examination showed a wound of entrance just above the head of the right fibula; the track of the bullet appeared to have been more or less transverse, but there was no wound of exit. The joint was distended with blood, slightly flexed, and very painful. Two skiagraphs were made by Dr. Welker (Figs. 1 and 2): the anteroposterior view located the bullet just to the outer side of the spinous process separating the two articular surfaces of the tibia, within the joint; while the lateral view showed the bullet just at the posterior border of the articular surface. There was no evidence of injury to the popliteal vessels, though the bullet was lodged within approximately a half inch of the artery.

Operation (seven hours after the injury): An incision of four inches was made longitudinally on the outer side of the joint, passing through the wound of entrance. The joint was opened and a quantity of fluid blood evacuated. There was a little splintering of the head of the tibia and external semilunar cartilage. The posterior capsule was cautiously dissected off the joint nearly to the midline, when the bullet (calibre .22) was felt by the finger and easily extracted with bullet forceps. The bullet was flattened on one side, as if it had struck somewhere else first and ricocheted.

The joint was freely irrigated with hot corrosive sublimate solution (1:2000), removing more blood and clots, and was drained with a rubber tube. The external lateral ligament was

carefully repaired with chromic catgut, and the wound was closed with additional drainage (iodoform gauze) to the site of the bullet. The knee was dressed on a posterior splint.

The tube was removed on the third day; weight extension was applied October 24, as the knee showed a persistent tendency to flex. The wound was entirely healed in six weeks, without any signs of arthritis having developed; and the patient was discharged December 19, 1908, wearing a plaster cast. She was referred to Dr. Davis' service at the Orthopædic Hospital, and was fitted with a brace, arranged to allow gradually increasing



Anteroposterior and lateral views of gunshot wound of right knee joint.
Fig. 1, Anteroposterior view. Fig. 2, Lateral view.

motion at the knee joint. She wore this until the end of May, 1909, at which time she had full extension of the knee, and flexion to a right angle. She walks now without any limp, has flexion to 65°, and knee seems as good as ever. (See Figs. 3 and 4.)

GUNSHOT WOUND OF THE SKULL, WITH RUPTURE OF THE LONGITUDINAL SINUS.

DR. ASHHURST also related the history of a man, aged 32 years, who shot himself in the centre of the forehead with a bullet of .38 calibre, aiming directly backward. He was at once taken

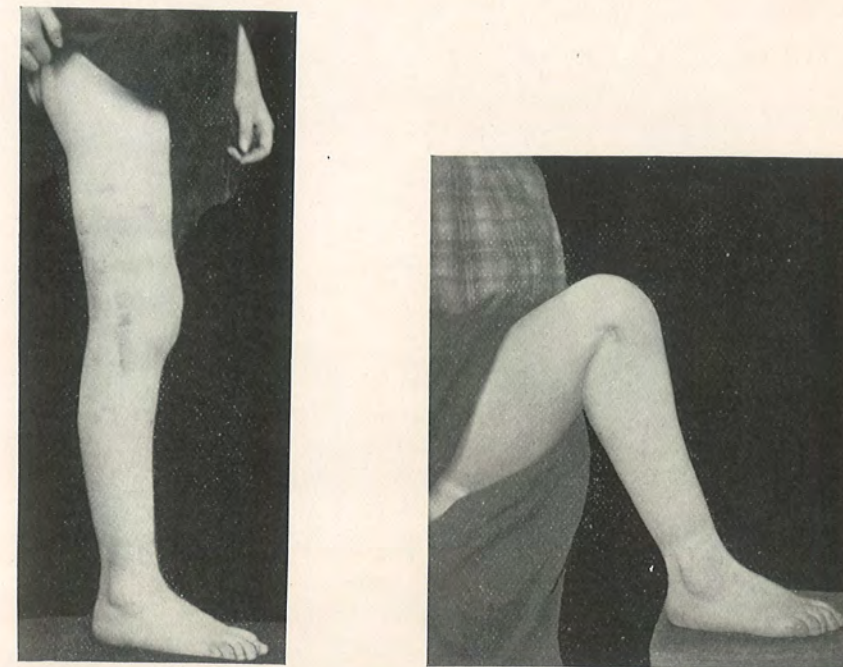
to the Episcopal Hospital, where he was admitted to the service of Dr. G. G. Davis (February 13, 1909), to whom Dr. Ashhurst is indebted for the privilege of operating.

When admitted there was moderate bleeding from a stellate wound of the soft parts directly in the centre of the forehead, below the hair border. Powder burns were conspicuous. Immediate operation was deemed advisable, as the wound was so dirty that it could only be cleaned by a formal operation. The patient was etherized, and all burned soft parts were cut away, and the wound thoroughly cleansed. One angle of the stellate opening was enlarged backward, exposing a jagged hole in the skull, about one inch in diameter; two fragments of the bullet (very much deformed) and many small pieces of charred bone were picked out of the hole. The inner table was much comminuted, driven in against the dura, and impacted; it was impossible to dislodge these fragments until the opening in the skull had been enlarged by a rongeur. A trephine was not used. On extracting the forward piece of the inner table there was a jet of blood from the superior longitudinal sinus, which was checked by packing. As each other fragment of bone was removed from the position where it was caught in the wall of the longitudinal sinus, profuse hemorrhage occurred; this was readily controlled by packing, but this packing had to be removed several times to search for and remove other fragments of bone. The dura overlying the hemispheres of the cerebrum was not ruptured, and the brain was not exposed; but the longitudinal sinus was extensively torn, and only the impaction of the skull fragments in the walls of the sinus prevented the man from bleeding to death before admission to the hospital.

For permanent control of the hemorrhage from the longitudinal sinus two strips of gauze were used, each two inches wide and 24 inches long.

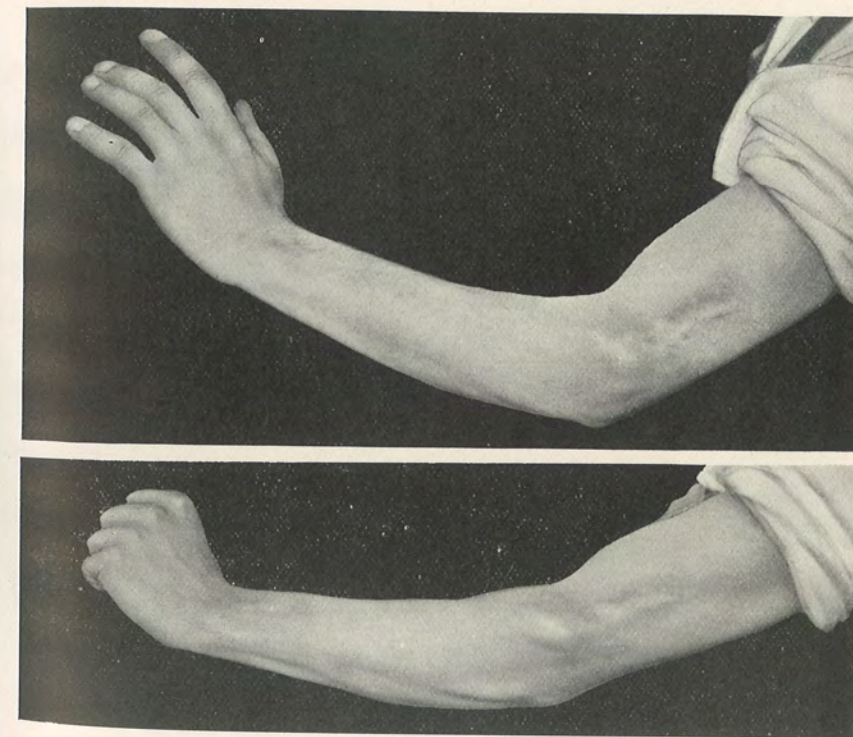
The patient did well after the operation. The packs were removed without accident three days later; and his subsequent convalescence was uneventful. He was kept in the hospital a little over three weeks; has had no symptoms referable to his head since his discharge, and is now in excellent health.

FIGS. 3 and 4.



Result of arthrotomy for gunshot wound of the knee joint.

FIGS. 5 and 6.



Result of primary neurorrhaphy for stab wound of the musculospiral nerve (16 months after operation).

AMPUTATION OF LEG UNDER ANÆSTHESIA PRODUCED
BY INFILTRATION OF THE SCIATIC NERVE
WITH EUCAINE.

DR. ASHHURST related the history of a man, aged 33 years, who tried to jump on to a rapidly moving freight train. His feet slipped, but he had a firm grip with his hands, and held on. His body swung in and out between two cars, his efforts to regain his footing were ineffectual, and, fearing instant death if he let go, he was dragged along for *one mile* before his cries caught the attention of the train hands; the train was then stopped, and the patient was hurried to the Episcopal Hospital, where he was admitted (October 4, 1909) to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating.

The patient was almost pulseless; he had profuse hæmaturia; there was a large hæmatoma in the left loin; the left ilium was fractured through the ala; the left foot was crushed and frightfully mangled; and there was a fracture of the shaft of the left radius. Although the patient was not expected to survive, he gradually reacted under vigorous treatment, but developed pneumonia, first in the left lung, and then in the right. The hæmaturia gradually diminished. The left foot became gangrenous, but on account of the pneumonia and the other injuries amputation was postponed as long as possible. Finally, on the fifth day after the accident, in spite of the patient's bad general condition (double pneumonia, with restlessness and delirium), it was deemed imperative to remove the leg, as the stench was insufferable, and it was feared the gangrene might cause additional sepsis.

On October 9 the patient was given a hypodermic injection of morphine and atropine, and the sciatic nerve was exposed in the buttock by infiltrating the skin over it with eucaine; this was somewhat difficult as the patient began to suffocate as soon as an effort was made to turn him on his side. But by bringing his buttock partly over the edge of the table the nerve was exposed, and injected with 15 to 20 minims of 2 per cent. eucaine solution. This wound was then closed. Next the line of the proposed skin incision for the internal flap (supplied by the internal saphenous nerve) was anæsthetized by the local use of eucaine, and the leg was amputated (Sédillot's lateral-flap method, modified) without

the patient suffering more than from the tactile sensation of the instruments. All pain sense was abolished.

The patient's convalescence was tedious, but uncomplicated. The various injuries have healed, leaving no apparent disability, and he has an excellent stump.

PRIMARY NEURORRHAPHY OF MUSCULOSPIRAL NERVE FOR STAB WOUND: PERFECT FUNCTIONAL RECOVERY.

DR. ASHHURST related the history of a man, aged 17 years, who was stabbed in the left arm, probably with a penknife, about midnight of October 7, 1908. He was taken at once to the Episcopal Hospital, and admitted to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating. On admission the boy had a band tied tightly around the upper arm, to control profuse hemorrhage from a punctured wound above the external condyle of the left humerus. The stab wound was enlarged by the Resident, and several spurting vessels were ligated. The next day, on examination, it was noticed that there was wrist-drop; there was complete paralysis of both the posterior interosseous (inability to extend fingers or wrist) and the radial nerves (anæsthesia over extensor surfaces of thumb and index fingers, and over the anatomical "snuff-box").

Operation was done sixteen hours after the injury. It was found that the stab had passed through the fibres of the brachialis anticus muscle almost to the bone; the proximal end of the musculospiral, cut cleanly across, was found in the wound; the distal end had retracted, but was easily found by separating the brachialis anticus and brachioradialis muscles. The distal end was then pushed under the uncut fibres of the brachialis anticus, and sutured to the proximal end by two mattress and one simple suture of fine silk, threaded in an ophthalmic needle. The two mattress sutures were passed directly through the trunk of the nerve; while the simple suture passed through the sheath only. After the suture was completed the place of union could no longer be detected with the naked eye; there was apparently perfect apposition. The wound in the brachialis anticus and the deep fascia were separately sutured with chromic catgut, and the skin was closed with silkworm gut, a small gauze wick being left for drainage. The arm was dressed on an internal angular splint. The wound healed without suppuration.

There was gradual improvement in the wrist-drop after about three months, although the patient was treated with massage and electricity for only a very short time. At the end of a year recovery was complete. There is now only the slightest evidence of impairment of power in the muscles supplied by the posterior interosseous, and no anæsthesia exists; the fingers and wrist can be fully extended, but not so vigorously as before (see Figs. 5 and 6).

THE DIAGNOSIS OF TYPHOID PERFORATION.

WITH REPORT OF CASES.

BY A. D. WHITING, M.D.,
OF PHILADELPHIA.

THE diagnosis of intestinal perforation during typhoid fever is, in the vast majority of instances, guesswork. Direct examination of the intestine, either on the operating table or at autopsy, alone will prove whether or not our surmise, *pro* or *con*, has been correct.

If we accept the findings of Brown (*Jour. Amer. Med. Asso.*, February 27, 1906, 695) based upon the statistics collected by Taylor, no fewer than 25,000 deaths occur annually in the United States from intestinal perforation during typhoid fever. This is in keeping with Osler's statement that one out of every three deaths during typhoid fever is due to perforation, which ratio is practically confirmed by the studies of the late J. Allison Scott (*New York Med. Jour.*, February 9, 1907, 245).

With this enormous number of perforations occurring annually one would naturally expect to find a great number of reported cases treated by operation—practically the only treatment giving any hope of recovery. Harte and Ashhurst (*ANNALS OF SURGERY*, January, 1904) were able to cite but 362 cases up to January, 1903, and Allaben, as quoted by Brown, could find but 162 reported operations between January, 1903, and January, 1907.

Granting that operative interference is the best treatment for typhoid perforation, this great discrepancy between the number of perforations and the number of reported operations would naturally lead one to conclude either that the estimated ratio of perforations to deaths is too high; or that it is most

difficult to make a diagnosis of perforation; or that but few of the operated cases have been reported.

From a study of cases of typhoid perforation that have come under my observation, and of the histories of similar cases at the German Hospital, I am forced to accept all three conclusions. The records of the German Hospital from 1900 to 1909 inclusive, show that there were treated in that institution during these ten years 2053 cases of typhoid fever, of which 206, or 10 per cent., died from various causes. In 180 of the 206 deaths there was no suspicion of perforation noted. Of the remaining 26 deaths, 17 were due to perforation, found either at operation or post mortem, and in 9 cases death was due to peritonitis, probably perforative, the diagnosis not being confirmed either ante or post mortem. If all suspected cases are classed as true perforations, perforation occurred in 1.26 per cent. of all cases; if the 9 cases not confirmed are excluded, perforation occurred in .82 per cent. of the cases. This percentage is somewhat lower than that shown by statistics published by Harte and Ashhurst, who in 8881 collected cases found perforation occurring in 2.54 per cent.

The ratio of the perforative deaths to the whole number of deaths in the German Hospital series would be, with the 9 doubtful cases included, 1 in 8; without the 9 cases, about 1 in 12, a ratio considerably lower than that advanced by Osler and by Scott.

The second conclusion, that it is most difficult to make a certain diagnosis of perforation, must be concurred in by all who have studied the subject or have seen many cases. Personally, I know of no sign or symptom that is pathognomonic of perforation; I know of no train of symptoms that will lead inevitably to a diagnosis of perforation. Nor can this be considered strange, if it be realized that the patient in question is one who is suffering from an infection which makes the abdomen the site of marked intestinal disturbances and which causes a profound toxæmia to affect every organ in his body, who may exhibit abdominal pain, and rigidity, and tenderness, and distention from the onset of the infection, and who may

present all of the supposed typical signs and symptoms of perforation during the course of the fever without the occurrence of this complication.

If from 25 to 40 per cent. of the perforative cases are to be saved, a diagnosis must be made and operative interference instituted before the patient is moribund from a rapidly spreading peritonitis. This is impossible in some instances because the added burden of the calamity of perforation overwhelms all resistance that the patient may still possess. Such cases, naturally, succumb before relief can be afforded. In the majority of cases, however, the resistance of the patient will be sufficient to withstand the complication of perforation long enough to make operative interference not only advisable but mandatory.

Perforation should be suspected in every instance where the regular course of the typhoid infection in that individual case has been interrupted by some untoward mishap. Perforation should be diagnosed in all such cases, when the mishap cannot be traced directly to some complication other than perforation.

The recognition of such occurrence presupposes a thorough knowledge of the case in question obtained by painstaking and continuous study of the patient and of the various phases of the fever presenting. The possession of this knowledge by the physician in charge makes it obligatory on him to make the diagnosis and to look upon the surgeon as his mechanic rather than his consultant, unless the surgeon has studied the case with the physician before the mishap occurred. The surgeon may be able to aid the physician in determining the presence or absence of rigidity, of beginning or established peritonitis, of free fluid in the abdominal cavity; but it would be presumptuous on the part of the surgeon to attempt to recognize the occurrence of something out of the ordinary in a particular typhoid fever patient about whom he knows nothing from previous personal observation.

While it is true that this scheme of diagnosis does not take into consideration the presence or absence of any sign or

symptom or train of symptoms that may have been looked upon as indicative of perforation, it is probable that it would be productive of less harm than would waiting and searching for symptoms that may or may not appear. Mistakes would undoubtedly be made, and some patients whose condition would contraindicate operative treatment unless it were imperative would be called upon to withstand the added burden of an unnecessary operation. Were this mistake impossible under the method of diagnosing by a sign or symptom or chain of symptoms, the latter would be a better and safer scheme by which the diagnosis should be made. Unfortunately such is not the case. In the German Hospital series, two cases were operated upon in which no perforation was found. Mitchell (*Penna. Med. Jour.*, 1908) has reported a series of 93 operations for typhoid perforation, in 19 of which no perforation was found and in 7 of which no cause for the symptoms presented could be found.

If reliance is to be placed on the symptoms that may or should be present, the diagnostician very often will be led astray. Pain is probably the most constant symptom, in typical cases being sharp and stabbing, and usually localized in the right iliac fossa. In typical cases, the pain should continue for some time. In the ordinary run of cases, the pain may be such as not to cause complaint on the part of the patient; it may be entirely on the left side, in the groin, along the penis, referred to the end of the penis, in the testicle, in the epigastrium or in any other part of the abdomen. Pain may be entirely absent, or the pain complained of may be nothing more severe than a slight exacerbation of that experienced by the patient during the entire course of the disease.

Vomiting may be a symptom of perforation, or may be the cause of it. Murphy of Chicago has stated that it is constantly associated with the perforative peritonitis of typhoid. This symptom was entirely absent in a large number of the cases in the German Hospital series.

A fall of temperature may immediately follow the perforation. It was not noted in the German Hospital cases,

possibly because the temperature was not taken always at the time of perforation, but later when beginning peritonitis caused a rise rather than a fall.

Collapse and sweating are supposed to be found in connection with the fall of temperature. These are found in a fair percentage of cases, but are not present in the majority of them.

Tenderness and rigidity generally follow perforation. The former is of less value than the latter because a great many typhoid patients have abdominal tenderness throughout the entire course of the fever. Rigidity becomes more marked with spreading peritonitis, as a rule. It must be remembered in this connection that rigidity can be elicited in any case of typhoid fever, whether perforative peritonitis be present or not, by unskilled, rough palpation. The rigidity to be distinguished is that due to reflex activity of the muscles consequent upon a beginning peritonitis, obtained by the skilful touch of the artist.

As a general rule, the pulse rate increases very markedly after perforation, running as high as 140 to 160 and becoming weak and thready. In some cases no change in the pulse rate will be noted.

A change in facial expression, which Harte and Ashhurst describe as a general weakening of the expression, may be noted at the time of perforation. By the time the attention of the physician in charge has been called to the occurrence of the mishap, this cast of countenance will generally be lost, being replaced by the former expression or that more typical of general involvement of the peritoneum. In a patient profoundly toxic, no change in expression may be noted.

It was thought, at one time, that a positive diagnosis of perforation in typhoid could be based upon an increasing leucocytosis. Unfortunately, even that sign may be claimed by only a part of the cases, it being almost as variable as most of the other signs and symptoms advanced. One or two counts would be of practically no value under any conditions, unless the normal leucocyte count of that particular case had

been noted before perforation, as investigation has shown that leucopenia is not constantly associated with typhoid fever.

The two signs of perforation mentioned by Brown, namely, a "dipping crackle" elicited by a dipping palpation with the stethoscope; and the extension of tenderness in a given direction by posture of the patient, were not applied in any of the patients in this series. Whether they would be of material advantage in arriving at a correct diagnosis or not is questionable.

A brief summary of the cases in this series, details of which are appended, is as follows:

Death occurred in every case of perforation or suspected perforation where no operation was performed.

	No. of cases.
Death was due to perforation or peritonitis.....	26
Death was due to proved perforation.....	17
Death was due to possible perforation.....	9
Operation for perforation was performed.....	18
Perforations were found at operation.....	16
Perforations were not found at operation.....	2
Death followed operation for perforation.....	11
Recovery followed operation for perforation.....	7

Operative mortality was 61.1 per cent.

In conclusion I wish to thank the staff of the German Hospital for the privilege of reporting this series of cases. Most of the operations for perforation were performed by Dr. Deaver.

Following are details of cases of perforation or suspected perforation during typhoid fever occurring in the German Hospital between 1900 and 1909:

CASE I.—W.F., male aged 24; admitted April 21, 1900. Had severe pain and abdominal distention. Died from peritonitis, probably perforative. No operation. No autopsy.

CASE II.—C.K., male, aged 46; admitted August 15, 1900. Had several severe hemorrhages. Died from peritonitis. No operation. No autopsy.

CASE III.—W.J., male, aged 36; admitted March 2, 1901.

On admission abdomen was distended, there was pain and tenderness in right iliac fossa. Patient in collapse. No operation advised. Post-mortem examination, 36 hours later, showed perforation of the ileum, 4 inches from the ileocæcal junction.

CASE IV.—J.M., male, aged 28; admitted February 6, 1902, on the seventh day of typhoid. At 5.45 A.M. on the tenth day of disease, patient complained of pain in right iliac fossa, following a bowel movement. Temperature, 105°; respiration, 32; pulse, 120. There was tenderness over the right side of the abdomen, with beginning distention. At 6.20 A.M.: Temperature, 105 4/5°; respiration, 36; pulse, 136. Abdomen distended and hard. Vomiting was more or less continuous. Leucocyte count at 5.30 A.M. was 5200; at 6.30 A.M., 5600. Diagnosis: Perforation.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable fluid in peritoneal cavity. The appendix was retrocæcal, swollen and injected, and was removed. A large perforation in the ileum about 8 inches above the ileocæcal junction was found and closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient died 24 hours after operation from exhaustion.

CASE V.—W. K., male, aged 29; admitted November 2, 1902. Case previously reported by Dr. G. G. Ross, in *Phila. Med. Jour.*, May 2, 1903.

CASE VI.—J.J., male, aged 37; admitted February 6, 1903. While at work eight days before admission, had been suddenly taken with severe chill. Went to bed where he remained three days. Then had no pain and felt well, although somewhat tired. Remained out of bed on the fifth day, but did not return to work. On the sixth day presented himself to the out-patient department for treatment. That same evening he had a sudden, sharp, burning pain in the pubic region. In two or three hours, pain was felt in the abdomen and also in the right testicle with a sensation of retraction of that organ. Pain was constant with acute exacerbations. He vomited once. Did not void urine from onset of attack of pain until admission. On admission, temperature, 101 4/5°; respiration, 40; pulse, 128. Abdomen was scaphoid, abdominal muscles tense and markedly rigid. There was marked tenderness over entire abdomen and flanks.

Percussion note was dull over abdomen from pubes to umbilicus. Marked tenderness on rectal examination. Lungs showed impaired resonance at right apex with many crepitant râles; subcrepitant râles found over entire chest anteriorly. Catheterization caused great pain; 275 c.c. urine recovered. Leucocytes numbered 17,480. Diagnosis of peritonitis made.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Free pus found. Drainage tube introduced into pelvis and wound closed to drainage. No search for cause of peritonitis. Death 22 hours after operation.

Autopsy: General purulent peritonitis, pus being general, but more plentiful in pelvis. Small intestine in pelvis covered with thick slough. Small, ragged circular perforation of ileum about 10 inches from ileocæcal junction. Three other ulcers having characteristics of typhoid were found. Spleen was greatly enlarged. Kidneys showed acute parenchymatous change. Gall-bladder negative. Mesenteric and retroperitoneal glands were enlarged. Appendix showed superficial inflammation, limited to the peritoneal coat, secondary in character.

CASE VII.—J.P., male, aged 18; admitted March 1, 1903, on the eleventh day of typhoid. General distention of abdomen; tenderness over splenic and gall-bladder regions; gurgling and tenderness in right iliac fossa.

At 5 P.M. on thirty-fourth day of disease, patient had severe pain over splenic area. Temperature, 104 1/5°. At 7 P.M. complained of pain over sternum, which gradually spread to epigastrium and then over entire abdomen. Slight rigidity of left rectus. General abdominal pain, more marked on left side. Some tenderness over gall-bladder. There was no distention, abdomen being scaphoid.

At 8 P.M., pain and tenderness became localized in right side and there was dullness in right flank. Slight rigidity of right rectus. Temperature, 103 2/5°; pulse, 120; leucocyte count, 18,800. Was transferred to surgical ward at 8.20 P.M., with diagnosis of perforation.

Operation by Dr. Whiting. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable cloudy fluid in peritoneal cavity. Appendix slightly injected; it was removed. Intestinal peritoneum was injected and red. Intestine searched for perforation but none found. Pus was found

behind liver, and more in pelvis. Gall-bladder was normal. Peritoneal cavity irrigated with saline, drainage tube introduced into pelvis and wound closed to drainage. Patient made an uneventful recovery.

CASE VIII.—W.C.W., male, aged 25; admitted March 24, 1903, on the thirteenth day of typhoid. Was profoundly toxic and ran a prolonged course of typhoid. On the forty-second day of disease, had a large hemorrhage from the bowel. On the forty-eighth day of disease, at 11 A.M., temperature, $104\frac{4}{5}^{\circ}$; respiration, 28; pulse, 128. He was in a semi-comatose condition. At 11.55 A.M. was screaming with pain. No fall of temperature was noted. He very soon became more easy and at 12.15 P.M. had a large, formed yellow stool. He was perspiring freely. There was no vomiting. At 1 P.M. complained of severe abdominal pain. At 2 P.M., temperature, 105° ; respiration, 36; pulse, 138.

Operation by Dr. Deaver, at 2.15 P.M. Ether anæsthesia. Incision through right rectus. Peritoneal cavity filled with cloudy fluid. Peritoneum deeply injected. Round perforation found 12 inches from ileocæcal junction, in ileum. Perforation closed. Appendix deeply congested; it was removed. Glass drainage placed in pelvis and wound closed to drainage. Patient died 26 hours after operation.

Autopsy revealed general peritonitis. Appendiceal and perforation wounds closed. Distal to the sutured perforation, three other perforations were found within a distance of four inches.

CASE IX.—J.C.L., male, aged 30; admitted April 24, 1903. Had had a bad diarrhœa for one week but had followed occupation of driver until 24 hours before admission. At that time had dull pain in right iliac fossa which gradually increased in severity. There was no vomiting. On admission, temperature, $102\frac{2}{5}^{\circ}$; respiration, 46; pulse, 148. Tongue was dry, fissured and heavily coated. Pupils were dilated. Pulse rapid but of fair tension. Abdomen markedly rigid throughout. Tenderness over entire abdomen, more marked on right side. Marked tenderness on rectal examination.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Peritoneum opened allowing escape of fluid fecal matter. Peritoneum sticky, lustreless, and injected,

Numerous typhoid ulcers were seen in ileum, with perforation in base of one of them. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died next day. No post-mortem examination made.

CASE X.—T.C., male, aged 31; admitted June 22, 1903. Died of peritonitis. No operation. No autopsy.

CASE XI.—A.M., male, aged 22; admitted January 13, 1903. Died of peritonitis, probably perforative. No operation. No autopsy.

CASE XII.—M.R., male, aged 14; admitted February 26, 1904, in second week of typhoid. Had been treated at home. Physician had diagnosed perforation and had sent him to hospital for operation. On admission, temperature, $98\frac{4}{5}^{\circ}$; respiration, 24; pulse, 118. Tongue coated, red, and dry. Patient complained of pain in lower abdomen, more marked on right side. Slight abdominal distention. No mention made of vomiting.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Cloudy, straw-colored fluid in peritoneal cavity. Ileum carefully searched for perforation, but none found. Near the ileocæcal junction, in the ileum, were a number of very thin places, at which points the mucous membrane had been apparently destroyed. At several points the intestine contained clotted blood. Wound closed without drainage. Patient ran a normal course of typhoid, temperature reaching normal on eighteenth day after operation. Recovery.

CASE XIII.—S. B., female, aged 35; admitted Mar. 25, 1904, on twelfth day of typhoid. On twenty-second day of disease patient had two hemorrhages of 600 c.c. and 400 c.c., respectively, from bowel. Temperature fell from $103\frac{4}{5}^{\circ}$ to $96\frac{3}{5}^{\circ}$. On the twenty-sixth day of disease had another hemorrhage of 250 c.c. On twenty-seventh day, at 7 P.M., complained of severe pain in region of urinary bladder. Temperature, 101° ; respiration, 22; pulse, 122. At 8 P.M. had a slight chill. Temperature, $102\frac{2}{5}^{\circ}$; respiration, 24; pulse, 144. At 12 midnight complained of severe pain in right side of abdomen. Temperature, 104° ; respiration, 28; pulse, 156. Patient did not vomit.

Operation at 2.30 A.M., by Dr. Whiting. Ether anæsthesia. Incision through right rectus. Omentum found adherent to entire right iliac fossa. Omentum liberated. Two perforations, one patent, round, in centre of large necrotic area, about two

inches from ileocaecal junction. Other found at ileocaecal junction, being closed by adhesion of ileum to caecum. Both perforations closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient had a severe hemorrhage 24 hours after operation and died of exhaustion 36 hours after operation.

CASE XIV.—R.D., male, aged 43; admitted July 15, 1904, on fifteenth day of disease. On the twentieth day of disease had sudden abdominal pain at 11.30 A.M. Temperature, $101\frac{3}{5}^{\circ}$; respiration, 26; pulse, 96. At 1.20 P.M. had a chill followed by rise of temperature to $105\frac{2}{5}^{\circ}$; respiration, 28; pulse, 128. There was persistent vomiting and hiccough. Patient died at 10 P.M. from peritonitis, probably perforative. No operation. No autopsy.

CASE XV.—J.T., male, aged 47; admitted December 13, 1904, on twelfth day of typhoid. On the fifteenth day patient lost 800 c.c., 500 c.c., 300 c.c., and 250 c.c. of blood by bowel in successive stools. On the sixteenth day of disease a perforation of the bowel was suspected, but as the patient was practically moribund, operation was not considered. Patient died the same day. No autopsy.

CASE XVI.—J.T., male, aged 15; admitted January 30, 1905, on the ninth day of typhoid. Abdomen slightly distended, tenderness in right iliac fossa. Spleen distinctly palpable. Patient had four distinct hemorrhages on the fourteenth day of disease and another on the twentieth day. At 12 o'clock noon on the twenty-ninth day, patient had severe abdominal pain in the end of the penis. There was no shock, abdomen was soft and flat. Temperature, 103° ; respiration, 26; pulse, 100. There was no vomiting. At 2 P.M. there was some rigidity of the recti, with slight tympany. Temperature, $102\frac{3}{5}^{\circ}$; respiration, 20; pulse, 120.

Operation at 4 P.M. by Dr. Deaver. Ether anaesthesia. Incision through right rectus. Perforation of caecum found on inner side. Perforation closed. Glass drainage in pelvis. Wound closed to drainage. Patient died at 8.35 P.M. from oedema of the lungs.

CASE XVII.—J.N., male, aged 43; admitted May 27, 1905. Six days before admission felt sharp pain in right side radiating to umbilicus, accompanied by dull headache with occasional pains shooting through head. Since onset of attack been feeling tired

out; bowels very loose, eight movements daily, watery in character. Felt somewhat better after vomiting, being relieved of abdominal pain. On admission abdomen soft, scaphoid, with no tenderness. Two days after admission experienced sudden sharp pain in general abdomen, with abrupt rise of temperature to $105\frac{2}{5}^{\circ}$. Expulsion of large amount of flatus gave relief of all pain. Next morning pain had returned, being localized in right iliac fossa, with considerable muscular rigidity on right side. Diagnosis of acute appendicitis made and patient transferred to surgical.

Operation by Dr. Deaver. Ether anaesthesia. Incision through right rectus. Appendix congested with exudate around it. Appendix removed. Glass tube introduced into pelvis and large quantity of sero-pus removed. Appendix opened and mucous membrane found normal. Ileum searched and several typhoid ulcers found. One perforation found, fecal matter being discharged. Wound closed to drainage. Patient ran regular course of typhoid, temperature touching normal on thirteenth day after operation. Recovery.

CASE XVIII.—W.Y., male, aged 20; admitted August 25, 1905, after four weeks' illness with typhoid. Three days after admission had sharp pain in right iliac fossa, abdomen slightly distended, increasing rigidity of both recti. Face ashen hue. Pulse rose to 160. Patient died from peritonitis. No operation. No autopsy.

CASE XIX.—W.Z., male, aged 21; admission September 1, 1905. On thirty-first day of disease, had sharp pain in abdomen which awoke him from a sound sleep. Pain lasted two hours. Several points of tenderness, with very slight distention over right hypochondrium. Patient was very thirsty and had an anxious expression. On thirty-ninth day a pelvic collection was made out. Patient died on the forty-second day of the disease, from peritonitis. No mention is made of suspected perforation. No autopsy.

CASE XX.—E.M., male, aged 37; admitted November 18, 1905, with typhoid fever, complicated by pneumonia. Nine hours before death had sudden severe abdominal pain, followed by collapse. No operation. No autopsy.

CASE XXI.—J. S., male, aged 14; admitted May 2, 1906, on eleventh day of typhoid. Had considerable pain in abdomen and

gave appearance of having been a great sufferer, being markedly emaciated and having abdominal facies. Temperature, 102° ; respiration, 32; pulse, 120. There was marked rigidity on right side, board-like in character. There was general tenderness. Abdomen was greatly distended. Patient died on third day after admission from peritonitis, probably perforative. No operation. No autopsy.

CASE XXII.—J.R.H., male, aged 33; admitted May 18, 1906. For two weeks before admission had suffered from general malaise, headache, anorexia, and excessive diarrhoea. Continued at work until five days before admission. On day before admission had sudden sharp pain in left groin which extended along the penis and lasted about ten minutes. Has had two similar attacks of pain since first. There was no nausea and no vomiting. On admission, temperature, 101° ; respiration, 24; pulse, 100. There was general abdominal pain and tenderness, both of which were more marked in left iliac fossa. Widal was suggestive. Leucocytes, 10,400.

Operation immediately after admission by Dr. Deaver. Chloroform anæsthesia. Incision through right rectus. Large quantity of pus escaped from peritoneal cavity. Plastic exudate throughout the peritoneal cavity. Appendix congested, not removed. Superficial search made for perforation but none found. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died twenty-two hours after operation.

Autopsy: General plastic peritonitis. Intestine contained numerous typhoid ulcers, one of which had perforated about 18 inches from the ileocæcal junction.

CASE XXIII.—A.G., male, aged 26; admitted October 9, 1906, on the ninth day of typhoid. Had hemorrhages from bowel on the eleventh, fourteenth and sixteenth days of disease. At 9 A.M. on sixteenth day became very anæmic, with sighing respiration, and decided air hunger. Diagnosis of concealed hemorrhage made. Abdomen slightly tympanitic but not rigid. There was no mention by the patient of pain. Perforation was later suspected on account of rise of temperature from $102\frac{4}{5}^{\circ}$ to $107\frac{4}{5}^{\circ}$, and rapid wiry pulse. There was a large hemorrhage from the bowel just before death.

Autopsy: Extensive ulceration in the last 18 inches of the ileum and about 8 inches of ascending colon. There was a per-

foration in the ileum 2 inches beyond the ileocæcal junction. The liver and kidneys showed acute parenchymatous change. Fecal matter was present throughout the peritoneum which was the seat of marked inflammation.

CASE XXIV.—W.S., male, aged 28; admitted December 12, 1906, with perforative peritonitis complicating typhoid fever. No operation. Died twenty-four hours after admission.

Autopsy: Perforation of ulcer of ileum, with general peritonitis.

CASE XXV.—A. F., male, aged 24; admitted December 12, 1906, with history of having had a bad cold for a week and having felt wretched. Twenty-four hours before admission had been suddenly seized with violent, sharp abdominal pain, soon followed by vomiting. Pain remained general but was more marked on right side. On admission there was marked dyspnoea, respirations rapid and labored, sputum rusty in color. Impaired resonance at right base and numerous large moist râles. Temperature, $101\frac{4}{5}^{\circ}$; respiration, 36; pulse, 108. There was extreme tenderness over lower abdomen, more marked over appendix, with moderate abdominal distention. Leucocytes, 12,200. Diagnosis of acute appendicitis with pneumonia made.

Operation by Dr. Deaver: chloroform anæsthesia. Incision through right rectus with escape of pus when peritoneum was opened. Numerous adhesions near appendix. In breaking up adhesions, three pockets of pus were opened. Appendix to inner side of cæcum, removed. Glass drainage tube introduced into pelvis and considerable pus removed. Gauze drainage introduced into pelvis and to base of cæcum. Wound closed to drainage. A fecal fistula developed immediately after operation, which persisted for about two weeks, finally closing without operation. Nine days after operation, rose spots appeared on abdomen and a positive Widal was obtained. The patient ran a regular course of typhoid and recovered.

CASE XXVI.—L. S., male, aged 31; admitted April 8, 1907. On seventh day after admission patient had attack of severe abdominal pain in lower right quadrant with rigidity of right rectus, followed by free bowel movement. Leucocyte counts: 2 A.M., 5200; 4.30 A.M., 10,500; 6.45 A.M., 12,700; 8.15 A.M., 6400, a second count at this time giving 7100. There was no vomiting. At 2.30 A.M. patient had a large bowel movement with hemorrhage.

Operation at 11 A.M., by Dr. Whiting: ether anaesthesia. Incision through right rectus. Considerable free pus and fecal matter in peritoneal cavity. Perforation found 6 inches from the ileocaecal junction, in the ileum. Drainage tube introduced into pelvis and large amount of pus and fecal matter evacuated. Wound closed to drainage. Patient died next day. No autopsy.

CASE XXVII.—S. S., female, aged 20; admitted May 8, 1907, on fourteenth day of typhoid. On twenty-second day of disease, patient had hemorrhage from the bowel. At 11 P.M. on the twenty-fourth day, patient complained of pain in the abdomen, which was entirely relieved by catheterization. Temperature, $103\frac{1}{5}^{\circ}$; respiration, 20; pulse, 124. At 8.30 A.M. on the twenty-fifth day, patient had severe pain in abdomen, more marked in lower right quadrant. Pulse became weak and running, respiration being sighing in character. Patient vomited. There was some general abdominal tenderness and slight rigidity of the right rectus. Liver dulness was not impaired. A diagnosis of perforation was made, but owing to a difference of opinion among the consultants no operation was performed. Patient died on the twenty-eighth day of disease from general peritonitis.

Autopsy: General peritonitis due to perforation of the ileum about 5 inches from the ileocaecal junction.

CASE XXVIII.—W. P., male, aged 19; admitted October 21, 1907. Had been treated at home for typhoid. On the morning of admission had had an attack of excruciating pain in the abdomen followed by very rapid pulse. No mention made of vomiting. Diagnosis of perforation made and patient sent to hospital for operation. On admission, temperature, $103\frac{3}{5}^{\circ}$; respiration, 28; pulse, 124. Leucocytes numbered 10,300. The abdomen was retracted. There was no localized rigidity although there was a suggestion of greater firmness over right iliac fossa. Slight tenderness in right iliac fossa.

Operation by Dr. Deaver: ether anaesthesia. Incision through right rectus. Free air, fecal matter and pus found in peritoneal cavity. Perforation of ileum about 10 inches from ileocaecal junction was found and closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient continued regular course of typhoid, the temperature reaching normal on the twelfth day after operation. Recovery.

CASE XXIX.—H. G. K., male, aged 17; admitted January 28, 1908, in second week of relapse of typhoid, with history of having had a perforation the day before. Patient taken from ambulance to operating room. General distention of abdomen, with rigidity and tenderness.

Operation by Dr. Deaver: ether anaesthesia. Incision through right rectus. Free pus and fecal matter found. Intestine injected and covered with exudate. Perforation found in ileum 18 inches from ileocaecal junction. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died on third day after operation from peritonitis. No autopsy.

CASE XXX.—T. S., male, aged 17; admitted February 11, 1908, on fourteenth day of typhoid. Abdomen was somewhat full but soft. On thirty-second day of disease had severe abdominal pain, being found writhing with pain at 11.45 P.M. At 12 o'clock midnight, temperature, $103\frac{4}{5}^{\circ}$; respiration, 24; pulse, 104. The attack of pain was followed by a large bowel movement. Leucocyte counts: 11.45 P.M., 5600; 12.45 P.M., 5700; 2.45 A.M., 5200; 11 A.M., 5300. No changes were noted in pulse or temperature and for four days the patient was distinctly better in every way.

On the thirty-sixth day the abdomen became suddenly distended, the liver dulness being absolutely obliterated. Three different leucocyte counts gave 7500, 7400, and 7300 respectively. Patient died on the thirty-seventh day.

Autopsy: There was general peritonitis due to an old perforation which had taken place in the ileum about 12 inches from the ileocaecal junction, surrounded by dense adhesions which had formed a wall of an abscess. This had ruptured and caused the general peritonitis. In this case there were no symptoms of perforation except the initial pain.

CASE XXXI.—T. B., male, aged 24; admitted April 17, 1908, on the eleventh day of typhoid. On admission the abdomen was soft but showed general tenderness. Liver and spleen were not palpable. At 12 o'clock noon on the sixteenth day of disease, patient had a severe abdominal pain, followed by rigidity of the recti and some distention of the abdomen. Patient complained of frequent desire for stool and micturition. Temperature, 102° ; respiration, 28; pulse, 92. At 2 P.M., patient had a large stool

followed by another attack of severe abdominal pain. Temperature, $105 \frac{1}{5}^{\circ}$; respiration, 40; pulse, 112. Patient did not vomit. Rigidity of right rectus with distention.

Operation at 4 P.M., by Dr. Deaver: ether anæsthesia. Incision through right rectus. Slight amount of free fluid in abdominal cavity. Appendix examined and found normal. A perforation the size of a pinhead was found in the ileum about 8 inches from the ileocæcal junction. Ulcer bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient ran a regular course of typhoid and recovered.

CASE XXXII.—M. W., female, aged 18; admitted December 25, 1908. History of having been sick for eight days before admission. Apathetic: tongue heavily coated; sordes on lips; heart rapid; spleen enlarged. Abdomen generally tender with some distention. Musical râles at left base on deep inspiration. Pulse, 148. Ran regular course until January 20, 1909, when complained of severe cramp-like pain in lower abdomen, at 10.45 A.M. At 12 noon liver dulness extended to costal margin; there was no tympany. Slight tenderness over McBurney's point. Continuous chill and shaking. Cyanosis. Considered at this time possible perforation. Leucocytes, 10,800. At 1 P.M., given hot-water bags to extremities and ice bags to abdomen. Color good; temperature gradually rising. No abdominal tenderness, nor rigidity. At 3 P.M., leucocytes, 8600. Complained of weight of ice bag. No rigidity, liver dulness not diminished. At 4 P.M., some slight abdominal distention, liver dulness replaced by tympany. Very slight rigidity. Has felt nauseated once but has not vomited. At 7 P.M., consultation and operation advised.

Operation by Dr. Whiting: ether anæsthesia. Incision through right rectus. Beginning peritonitis with free fecal matter in cavity. Perforation found in ileum 8 inches from ileocæcal junction, with several ulcerating areas in adjacent portion. Perforation closed and one ulcer-bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Culture from peritoneal cavity showed pure growth of colon bacillus. Patient ran regular course of typhoid and made a good recovery.

CASE XXXIII.—E. I., female, aged 54; admitted June 14, 1909, on the seventh day of typhoid. On admission, temperature,

$104 \frac{1}{5}^{\circ}$; respiration, 44; pulse, 116. The abdomen was considerably distended and somewhat tense. Spleen not palpable. The distention continued increasing, becoming drum-like. There was persistent vomiting. Peritonitis from perforation was diagnosed but it was not considered advisable to operate on account of unfavorable condition of patient. Died twenty-six hours after admission.

Autopsy: Bronchopneumonia of both lungs. Enormous distention of peritoneal cavity by gas, with some free fecal matter. The intestine was flat, being matted against the posterior wall of the abdomen. Typhoid ulcers of the ileum and cæcum were present, with four perforations in the cæcum. There was also focal necrosis of the liver.

DR. JOHN H. JOPSON said that Dr. Gittings and he had made a statistical study of perforation in children in a paper published recently. In this study there were analyzed 45 cases published since Elsberg's paper, which appeared in 1902. They did not find any very marked difference in the symptoms in childhood than in adult life; they did find pain, tenderness, rigidity, distention, leucocytosis, vomiting collapse,—all valuable and all present in a considerable number of cases; a certain number of these symptoms were present in a large majority of cases. Another interesting fact was that the mortality was much lower in patients below puberty than in the adult class.

DR. CHARLES F. MITCHELL thought that the difficulty from a surgical standpoint in making a diagnosis in perforation in typhoid fever is that the surgeon does not see the case before the symptoms start. Very often he is called in when the patient is suffering from general peritonitis and then diagnosis is very simple. It is important that surgeons in a general hospital where there are a large number of typhoid-fever cases should study these cases with the physician, so that the diagnosis of perforation might be arrived at earlier. Another important thing is that when called in to see a doubtful case, it is best to defer decision until one can see the patient again, in order that one may have time to consider the case carefully, rather than to be obliged the first time one sees the patient to give a final decision as to whether or not perforation is present when one knows but little of the patient's former condition.

DR. WALTER G. ELMER said that with regard to conditions simulating perforation he could recall one case of a trained nurse who in the third week of typhoid fever, and with a temperature running pretty evenly at 103°, suddenly developed all of the symptoms of perforation—a sudden drop in the temperature from 103° to subnormal, followed by pain in her right side, with increasing local tenderness and muscular rigidity. At operation he found an acutely inflamed appendix and an acute peritonitis spreading up the colon. No perforation of the intestine or appendix had taken place. The appendix was removed, the incision closed and the patient recovered. This patient presented a typical clinical picture of intestinal perforation in typhoid fever.

DR. ROBERT G. LE CONTE remarked that as a rule the physician does not call in a surgeon until there is grave doubt in his mind as to whether perforation has taken place. The physician expects the surgeon in a few moments to make a diagnosis in a case in which he has been doubtful for hours, or perhaps even days; and having made a diagnosis, the responsibility rests with the surgeon and not the physician. If surgeons could study these cases for a few hours, from the time when the thought of perforation has first entered the physician's mind, fewer errors of diagnosis would be made. One must not forget that perforation can take place and be temporarily closed by adhesion to a neighboring coil of intestine or to the omentum, and he believed that when one finds at operation, perforations from the size of a lead pencil to a five-cent piece, that these started as minute openings which were temporarily closed off until the whole bottom of the ulcer had necrosed. Dr. Davis showed him a very interesting specimen some years ago from a patient that had had characteristic symptoms of perforation, in whom operation was not undertaken. The patient recovered from this attack, but eight or ten days later the symptoms reappeared, ending in death. At the autopsy the first perforation was found entirely closed by a plug of omentum which protruded into the lumen of the gut, and near by a second perforation was found patulous, which had caused the patient's death.

DR. G. G. ROSS said that he had had a case presenting typical symptoms of perforation upon which he operated promptly and found a plug of omentum plastered over the opening. He presumed there was an opening at the time, but he did not disturb

the plug of omentum but stitched the edge of it and returned the bowel. Two weeks afterwards the patient had a second perforation from which he died. At post-mortem it was found that the plug of omentum had held until the bowel around the edge had sloughed and that the track of the drainage tube had become gangrenous. This was an illustration of Dr. Le Conte's point, that the patient had a perforation reinforced by nature, then a sloughing around the plug of omentum.

DR. A. P. C. ASHHURST said that while the diagnosis of perforation in typhoid fever is difficult, it is much more difficult to diagnose the occurrence of a second perforation some days after the first has been sutured. When the patient is comparatively well in the first place and a peritonitis develops it is not difficult to detect, but when, as in a second perforation, the peritonitis simply increases, it is very difficult to make the diagnosis. If the diagnosis of these secondary perforations could be made and if the perforations were sutured, the mortality of typhoid perforation would be markedly reduced. Better than to cure perforations is to prevent their happening. Until within the last three or four years at the Episcopal Hospital they had had a tremendous number of typhoid cases, during one year about 125 in the wards constantly, and there were perforations in the usual proportion of cases. Upon the introduction of filtered water into northeast Philadelphia the number of cases in the wards dropped to an average of 10 or 12, with but 4 or 5 perforations in the last three years.

DR. A. D. WHITING (in closing) said that as to the value of leucocytosis, he would say that it is of but little value, some cases showing an increase followed by a drop, others showing no variation in the leucocyte count even when taken hourly or half-hourly. In the early cases of this series the leucocyte count was made much more frequently than at the present time. Generally one count is made, and if that is high it is supposed to indicate trouble in the abdomen other than ordinary typhoid. A leucocyte count is made in every case of typhoid and often a normal leucocytosis is found. He thought the leucocyte count of little value in determining the presence or absence of perforation.

In general, perforation gives a doubtful picture until there is a well-established peritonitis; even then one may operate and find no perforation. There is no doubt that pain, tenderness,

rigidity, and vomiting are of great value when present, but there are many cases where these are not present. There may be perforation and death where no symptoms of perforation have been noted. Of course, the typical case, with sharp, stabbing pain, the patient writhing in agony, followed by peritonitis, rigidity and tenderness, is easy to diagnose. The stand he takes is that all calamities occurring in a case of typhoid should be suspected as being due to perforation, and that perforation should be diagnosed and operation instituted when no other complication can be found to account for the calamity.

The reason so many of the cases at the German Hospital were operated upon was because of the general theory that operation is advisable if there is suspected perforation: an unnecessary operation will not do so much harm as an unoperated peritonitis from perforation. It was lucky that so large a number of cases showed perforation. It was due more to guesswork than actual skilful diagnosis. Diagnosis of spreading peritonitis is comparatively easy, but one cannot tell whether it is due to perforation, leakage, or what not.

The time of operation after diagnosis varied from 6 to 36 or 48 hours. Some cases had been treated at home for typhoid and had been brought to the hospital after perforation had been diagnosed, and operation was at once performed. There were two such cases which died and one which recovered.

The idea of having the surgeon in attendance with the physician in all cases of typhoid is good, and should be instituted if the burden of the diagnosis is to rest upon the surgeon. The stand he takes is that the physician, who knows the case and its general behavior and can readily note the presence of any symptom out of the ordinary, should be the one to make the diagnosis and not the surgeon; if the surgeon is to help in the diagnosis he should be in attendance on the case from the beginning.

In regard to cases of slow peritonitis, with slight perforation, which had been mentioned, there are several cases in this series where there was either leakage or two or more perforations taking place at different times; others show an attempt to wall off and protect the general peritoneal cavity. In one case two perforations were found, one apparently sealed by adhesion of the ileum to the cæcum. In another case the patient had a sharp pain with-

out rise or fall of temperature, without any other symptom at all, and afterward steadily improved for four or five days when there occurred an explosive peritonitis from which the patient died. Autopsy revealed a small perforation sealed off by adhesions between the site of the perforation and the abdominal wall, where an abscess had formed which finally ruptured.

The treatment of the peritonitis at the time of operation varies. Most of the cases operated upon by Dr. Deaver had the pelvis cleaned out, drainage being instituted by a glass tube in the pelvis and sometimes gauze into the pelvis and to the seat of perforation. In two of his own cases the abdomen was irrigated with saline solution, but in the majority of cases nothing was done beyond instituting drainage. The after treatment at the German Hospital is practically the Murphy treatment for peritonitis.

SARCOMA OCCURRING IN SCAR TISSUE OF THE BACK, WITH METASTASIS TO THE LUNG: PRESSURE NECROSIS OF THE AORTA, WITH HEMORRHAGE AND DEATH.

DR. ADDINELL HEWSON reported the history of a man, aged 72 years, who was admitted to the American Oncologic Hospital October 3, 1908, complaining of a growth in the scar of a very extensive burn over the spine and dorsal aspect of the right scapula.

He was injured in a railroad wreck 22 years ago, sustaining a very extensive burn, the scar of which extended on the dorsal groove from the seventh cervical to the second lumbar vertebræ, completely encircling the chest on the right side and including the shoulder and arm, fastening the right arm to the right side of the chest in such a way that the axilla was not more than 8 centimetres from the olecranon process of the ulna, this fixing the arm to the right side of the chest. There was pressure necrosis of the skin to the axillary side of the elbow.

After the healing of the burn his weight was only 70 pounds.

Later he was in a second railroad wreck, since which time he has had hæmiplegia of the left side and right-sided partial facial paralysis.

He had a fracture of the right tibia, the date of which could not be obtained; he sustained a right-sided, indirect, inguinal hernia by a fall at the Soldiers' and Sailors' Home which was reducible.

On examination a tumor was found (Fig. 7) which originated in the scar tissue over the supraspinous and infraspinous fossæ of the right scapula. This tumor was dark red in color, nodule-like, and showed a tendency to break down. At the circumference it showed evidence of infiltration into the surrounding tissues. No indurated glands could be felt anywhere. The patient noticed that this growth appeared about twelve months before he was first seen. It increased very rapidly and when first admitted to the hospital its base was 20 cm. in diameter. The masses composing this totality varied from the size of a pea to 7.5 cm. by 15 cm. The elevation of these tumors was 2 cm. There was a tendency to bleed freely on manipulation.

Before admission to the hospital some of the smaller nodules had been tied off but no microscopic examination had been made. Necrosis began about eight months before, since which time the growth had been more rapid. Where the tumors had broken down there was no tendency to excavation but to an increased proliferation of the tumor mass.

The patient's height was 5 ft. 6 in. and weight 155 pounds. The pupils were normal and reacted promptly to light and distance. There was no œdema, no clubbing of the fingers, and no palpable enlargement of the superficial lymph-nodes.

The tongue was clean, the mucous membrane of the mouth was slightly pale. The pharynx appeared normal.

The morning temperature was 97.8 degrees; the pulse 98, regular, of full volume and tension; the respirations were 24 per minute.

An examination of the lungs showed no pathological signs.

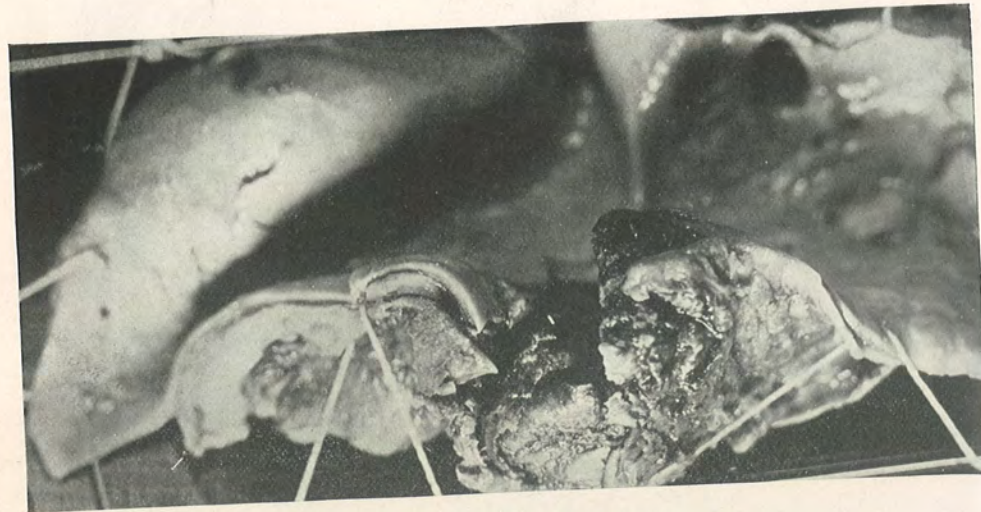
The heart apex beat was in the sixth interspace in midclavicular line, the cardiac dulness extended from the fourth rib to the sixth interspace and from left edge of sternum to the midclavicular line; no murmurs were heard. The pulmonary diastolic sound had a decided splashing quality. An examination of the abdomen showed no pathological signs except the right-sided inguinal hernia already referred to.

An examination of the blood showed: Erythrocytes, 3,700,000; leucocytes, 11,800; ratio, 1 to 313 +; hæmoglobin, 54 per cent.; color index, 0.73. Differential count: Polymorphonuclear neutrophils, 77 per cent.; lymphocytes, 13 per cent.; large mononuclears, 3 per cent.; transitionals, 2 per cent.; eosinophiles, 5 per cent.



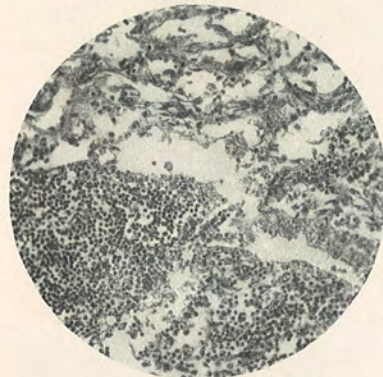
Sarcoma developing in scar tissue of the back.

FIG. 8.



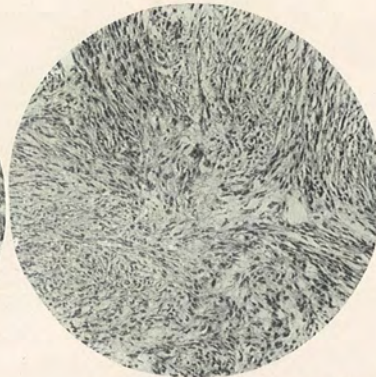
Showing erosion of wall of aorta by tumor.

FIG. 9.



Photomicrograph at the site of metastasis magnified 300 diameters taken at postmortem.

FIG. 10.



Photomicrograph of tumor of back magnified 150 diameters taken at first operation.

An examination of the urine showed: Color, dark amber; reaction, acid; specific gravity, 1016. There was a slight flocculent sediment which contained a few epithelial cells and uric acid crystals. There was no albumin, no glucose, no indican and no acetone.

After consultation with the entire Medical Board it was decided that cautery and X-ray be tried before dismissing what seemed to be a hopeless case.

Under strict asepsis and chloroform anæsthesia, a small tumor was enucleated at the most cephal part of the growth for examination and the opening closed. The caudal third of the growth was removed by a cautery knife, the remaining two-thirds were scarified with the cautery knife at red heat and one seemingly new growth was punctured in two places. The wound was dressed with dry gauze and cotton and a hypodermic injection of morphine was given. There was no elevation of temperature after this operative interference. It was noted 48 hours after the operation that proliferation of the growth had begun. The patient was out of bed three days after the operation and on the fourth day was able to walk some distance from the hospital.

On October 31 it was found that the growth had recurred over the entire area from which the tumor was removed by the cautery knife on the 12th, and that the new mass of tumor tissue was larger than that originally removed. On this date the Pacquelin cautery was again applied to the entire growth without the administration of an anæsthetic, because no pain was felt unless the uninvolved scar tissue was touched with the instrument.

A note on November 2 states that at the site from which the growth had been removed by the cautery knife, the tumor had increased to three times its original size. The electric cautery knife was then applied thoroughly to the entire mass without an anæsthetic.

Some of the cauterized material was removed on November 8 with considerable hemorrhage.

On November 15 the ward notes state that the discharge had been very profuse and offensive since the last cauterization. The patient showed a tendency to go down hill. The electric cautery was again used on November 18. On the 19th at 1.45 A.M. the nurse reported that after severe coughing there was some hemorrhage from the mouth, which lasted eight minutes. The

pulse rate was increased, regular and strong. At 4 P.M. of the same day some bright blood was found in the mucus, which was coughed up. On the 21st at 4 P.M. while sitting in the sun-parlor the patient was taken with a severe hemorrhage from the mouth, which came on without warning. The blood came out in a great gush; he became cyanosed, then strangled and died in 10 minutes.

I am indebted to Dr. C. B. Longenecker, Director of the Laboratory of Physics, for the photographs herewith submitted and to Dr. John M. Swan, Director of the Laboratory of Pathology, for reports of the pathological examination and autopsy. The examination of the specimen enucleated at the first operation resulted in a diagnosis of mixed-celled sarcoma.

The autopsy revealed the cause of death to have been hemorrhage from the aorta, due to pressure erosion of metastatic growth in posterior mediastinum between thoracic aorta and posterior margin of right lung.

In the caudal lobe of the right lung the lung tissue is replaced toward the dorsal part of the lobe by a solid mass resembling the new growth described on the surface of the body. Around this there is an area of less dense tissue, and farther removed again the lung looks normal except for the fact that it is quite moist.

There is a good-sized cavity in the part of the lung containing the neoplasm. The bronchi passing to this part of the organ are filled with clotted blood. The portion of the lung tissue adherent to the mediastinal tissues presents a small opening through which a probe can be passed to the thoracic aorta immediately beneath it.

The aorta is atheromatous. On the right side of the thoracic aorta just cephalad to the aortic opening in the diaphragm there is an irregular opening with ragged edges 12 mm. in diameter, into the mass of tissue already described as adherent to the mesial surface of the right lung. The interior of this mass contains a cavity about 20 mm. deep, which is filled with semi-fluid blood. There is no attachment apparent to the underlying vertebral column. The intercostal veins where they empty into the vena azygos major are patulous and filled with blood, and no connection can be demonstrated between the cavity and the vena azygos major (Fig. 8).

The tumor is composed of spindle cells. In many places there are good-sized bundles of fibrous tissue, which are undergoing granular degeneration, and there is a good deal of oedema to be seen (Figs. 9 and 10).

DR. G. G. ROSS said that it was discouraging to think how absolutely intractable such a growth is. Still another side to the picture are the suggestions of Bloodgood and Coley, both of whom show that the results in such cases depend upon the type of sarcoma to be dealt with. The so-called fibrosarcoma of Bloodgood, a low grade of malignancy, offers some hope for local procedure; in the other malignant types it was his experience that amputation does little good. He recalled a case of fibrosarcoma in a girl 12 years of age, who had injured her wrist; she presented a deformity like a typical Colles' fracture. The X-ray showed it to be a tumor, and a local operation was done. After three years the growth had slowly recurred but was in no worse condition than when originally seen. Amputation was then done at the shoulder. That was four years ago and the girl is still perfectly well. Coley claims that there are a number of cases of more malignant type in which the use of his toxins of streptococcus and prodigiosus after amputation offer some curative results.

DR. ROBERT G. LE CONTE said that his experience in these cases was that nearly all of them die of internal metastatic growths. Whether one amputates or simply resects the diseased area, it is not the local return but the internal growth that kills. He had had perhaps ten or a dozen amputations in which there was local recurrence in but one case, and yet, in all these cases, the patients ultimately died of internal growth.

DR. SWAN said the subject of sarcoma, of course, will not be settled until the cause is found. So far as his experience had gone, nearly all sarcomata are mixed-celled growths, and he made a diagnosis of type according to the predominating cell found. As he understands it, sarcomata begin as small round-celled growths. These round cells belong to the same class of cells as those found in the connective tissue in the embryo, and they become large round cells; these become spindle cells and the spindle cells may become converted into a varying amount of fibrous tissue. The origin of the giant cell is not definitely settled. At the American Oncologic Hospital in the last two

years, three cases of sarcoma, including this one, have been treated; the other two were sarcomata of the thigh, occurring in the service of Dr. McClary. According to the examination of the thighs after amputation these growths undoubtedly originated in the periosteum. One patient remained in the hospital until metastasis occurred in the retroperitoneal lymph-nodes. The metastatic growth was of the round-celled type, while the original growth was a spindle-celled sarcoma with a few giant cells.

The occurrence of sarcoma in a scar is very interesting and somewhat unusual.

DR. DUNCAN L. DESPARD called attention to two cases which Dr. Gibbon had already reported, one the case of a girl with sarcoma of the humerus in which he removed the growth and afterwards treated the girl with Coley's toxins; this was done over two years ago; and she still remains perfectly well. There was another case sent from up in the country with an abdominal growth, of which we never got a section, but her home physician was of the opinion from microscopical examination that it was a sarcoma. This growth was reduced 75 per cent. in size under the influence of the treatment with the Coley toxins. The patient went home and came back the second time in about the same condition as when first seen and was again treated by Coley's toxins and finally left the hospital without improvement of the symptoms. Both these cases were treated by the X-ray in addition to the toxins.

DR. ROBERT G. LE CONTE said that he had used Coley's mixed toxins in a number of cases without any apparent benefit except in one case, where a sarcoma of the upper jaw remained stationary for about six months. Dr. Stewart, his assistant at the Pennsylvania Hospital, attributed one most excellent result to this treatment. As an antithesis he related the history of a case of lymphosarcoma of the peritoneum, intestine, mesenteric glands and retroperitoneal glands which came under observation a year ago at the Pennsylvania Hospital. The man was so distended with ascites that no organ could be felt in palpating the abdomen, and the diagnosis seemed to lie between a tubercular peritonitis and diffuse carcinomatosis of the peritoneum. At operation the parietal, visceral and mesenteric peritoneum was found studded with growths varying from a pinhead to a penny in size, and at the upper portion of the jejunum an infiltrating tumor was found

the size of an orange. These tumors were pinkish in color and much richer in the small blood-vessels than carcinoma. The mesenteric and retroperitoneal glands were also enlarged. The abdomen was closed after removal of one of these growths from the parietal peritoneum for microscopic examination. The patient slowly grew weaker, with progressive emaciation, until he died seven weeks later. At the autopsy the growths which had studded the peritoneum had practically disappeared, and the tumor of the jejunum had dwindled to a thickening of the coats of the bowel, perhaps a quarter of an inch in depth. Nothing had been done of a curative nature for this patient except the opening of the abdomen and the handling of the tumors, yet the sarcomatous masses had receded to an enormous degree in seven weeks. This case is an example of a thing occasionally seen in lymphosarcoma, namely, marked diminution in the size of the tumor without its entirely disappearing and without prolonging the life of the patient.

**TREATMENT OF CHRONIC TUBERCULOUS SINUSES
BY BECK'S BISMUTH-VASELINE PASTE
INJECTIONS.**

BY JOHN B. SHOBER, M.D.,
OF PHILADELPHIA.

DR. EMIL G. BECK of Chicago published in the *Illinois Medical Journal*, April, 1908, a paper entitled, "A New Method of Diagnosis and Treatment of Fistulous Tracts, Tuberculous Sinuses and Abscess Cavities," and at the Sixth International Congress on Tuberculosis, held at Washington, D. C., September 28 to October 5, 1908, he presented another paper entitled, "The Surgical Treatment of Tuberculous Sinuses and Their Prevention."

In order to diagnose the extent and ramifications of chronic tubercular sinuses, with a view of determining the advisability of surgical operation, Dr. Beck injected a number of cases with a paste composed of one part bismuth and two parts vaseline and then had radiographs made. The pictures clearly showed the extent of the fistulous network in the cases and explained the reason of failure in several previous operations. They also demonstrated the uselessness of an operation which does not reach every part of the diseased tract. On the other hand, by the use of bismuth radiographs as a guide in reaching the entire seat of disease, several successful operations were performed. This announcement alone would have been sufficient to attract the attention of the profession, and in the future the method will doubtless be universally used before undertaking surgical operations in these cases.

But this was not all. The first case injected for diagnostic purposes led to a most important discovery, namely, that the

injection of liquefied bismuth-vaseline paste is not only valuable for diagnostic purposes, but for curative purposes as well. It disclosed a new method of treatment. In his first paper Dr. Beck says that after one single injection of the bismuth paste a fistula following a psoas abscess, which had existed nearly two years, entirely closed and has remained so up to date. Other cases were subjected to the same treatment with similar results. In his paper read before the International Congress on Tuberculosis Dr. Beck reported 192 cases treated by the bismuth-vaseline paste method, of which 64 per cent. were healed, 28½ per cent. improved, 6 per cent. unchanged, and 1½ per cent. died during the period of treatment or after. A large variety of cases were treated, including osteomyelitis of long bones with sinuses, empyema and tuberculous lung abscesses, suppurative sinuses of the head, sinuses following tuberculous glands, rectal fistulæ, and tuberculosis of the kidney with sinuses.

Impressed by Dr. Beck's first paper, I determined to try the method when occasion should arise. My personal experience has been confined to only five cases, but I have advised this method in consultation in a number of cases where the results have been equally gratifying.

My cases comprise 2 psoas abscess sinuses of five and three years' duration, 2 cases of tuberculosis hip joint with sinuses of two and three years' duration, in which one had been operated on twice and the other once, and one case of tuberculous sacro-iliac synchondrosis with sinuses of one and a half years' duration.

CASE I.—Referred to me by Dr. F. Fremont-Smith in August, 1907, in Bar Harbor, Me. A woman of 35 years, from whom I had removed a tuberculous right kidney in October, 1907, and the pelvic organs in December, 1907.* A persistent sinus existed from an old psoas abscess which was opened in 1902. No attempt was made to treat the sinus at the time of my operations. During the five years the sinus had existed it would frequently close,

* This case was reported in the *Therapeutic Gazette*, June 15, 1908, in a paper entitled "Nephroureterectomy for Tuberculosis."

causing great pain and requiring reopening which was always followed by a large discharge of pus.

In the summer of 1907 I diagnosed a tuberculous right kidney and proposed operation, which she accepted and went with me to Philadelphia. I removed a large tuberculous kidney and ureter and a month or so later was obliged to do a bilateral salpingohysteromyectomy for symptoms which made me suspect tuberculous disease of these organs. I found chronic pelvic inflammatory disease and a fibrous uterus. The patient returned to Bar Harbor that winter, rapidly gained health and strength and began to earn her own living. The psoas abscess sinus, however, persisted, and upon my return to Bar Harbor in June, 1908, I proposed treatment with Beck's bismuth-vaseline paste.

The opening of the sinus was just above the middle of Poupart's ligament, on the right side. Between June 25 and October 24 she had 12 injections. From the time of the first injection the character of the discharge changed from a characteristic irritating purulent discharge to a mild, thin mucopurulent discharge, and it rapidly grew less in quantity. At first I was able to inject about 3 drachms of the paste and finally not more than 30 or 40 minims, until, at last, on September 24, it had closed completely and has remained so to present date. Before her operation in October, 1907, her weight was 117 pounds. In June, 1908, when I began treating the sinus, she weighed 142 pounds. During the summer and autumn she gained 10½ pounds. I made two radiographs during the course of injections. The first shows a single tract sinus extending to and pocketing around the base of the third lumbar vertebra, and the second a month later showing the same sinus but much narrower than at first, and the third a very narrow streak of bismuth along the tract but a pocket of paste on the left side of the body of the vertebra.

This was a very instructive case and the lesson I learned from it was that I made a mistake in attempting to keep the paste in the sinus after injection, by plugging the mouth of it with gauze and strapping it down. Dr. Beck has also come to the conclusion that better results are obtained by allowing the paste to escape into the dressing. I believe that fewer injections would have been required had I done so.

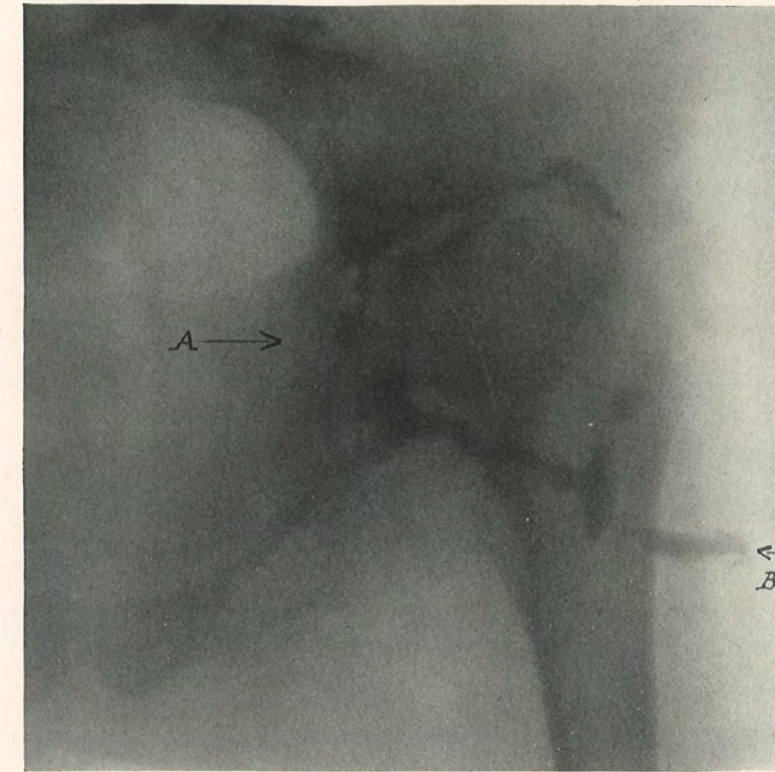
CASE II.—A similar case of psoas abscess sinus in a man of 27 years which had persisted for three years. The radiograph showed a straight tract to the third lumbar vertebra with a small pocket over the middle of its base. There were two bulging places and a widened place along the course of the tract. In this case I allowed the paste to drain into the dressings and noted that only a fraction of it escaped each time. After the fifth injection the sinus closed permanently. This case was treated in January, 1909, and has remained healed.

CASE III.—Referred to me by Dr. F. Fremont-Smith of Bar Harbor, Me. The man was an expert blacksmith, 32 years old, employed in a large buckboard factory. He had first consulted Dr. Smith three years previously for bilateral, very much enlarged cervical and axillary glands suggesting Hodgkin's disease. After careful study the condition was considered tuberculous. Subsequently several of the glandular swellings were incised but no distinct abscess cavities were found. For two years he led an out-of-door life and was placed on a carefully regulated hygienic, dietetic and tonic course of treatment and for a long time took regulated doses of arsenauo with the result that all the swellings entirely disappeared and he returned to work. One year before he was referred to me, which was in July, 1908, he began to suffer pain in the left hip on exertion. In December, 1907, a swelling appeared over the lower spine and sacrum. It increased slowly for four months and then the abscess opened spontaneously. It was a diffuse swelling, the size of two hands. There was one large bunch on the left side of median line and two smaller ones on the right side. A large quantity of pus escaped and one sinus on the left side immediately above the sacro-iliac synchondrosis had persisted, discharging pus freely and requiring two or more changes of dressing daily. I had this pus examined bacteriologically and tubercle bacilli were found. Injection of the pus into guinea pigs also gave positive results. Upon examination I found a small sinus opening to left of the median line one inch above the sacrum, and in a similar position on the right side there was a small red area, almost ready to open spontaneously, which gave a sense of fluctuation. Pressure over this area and also to the left and below the sinus caused a discharge of pus from it.

I gave him the first injection on July 10, 1908, and was able

to introduce easily one ounce of the paste which caused a well marked bulging on both sides of the sacrum immediately below the opening of the sinus and also a smaller bulging below the red spot above referred to. There was distinct improvement in the character and amount of discharge from the first, and after the fifth injection there was very little purulent discharge all summer. As time went on I was able to introduce less and less of the paste. On August 22, after the twelfth injection, it was noted that there had been only very slight, thin, translucent, brownish stained serum for a long time. At this time the cavities took only one-half ounce of the paste. There was a general feeling of firmness in and around the cavities on both sides. The rounded, firmly elastic bunch on the left side felt firmer. The skin moved freely over it. On the left side the injection caused no bunching and the tissues around this area felt firm and contracted. At the time of the twenty-first injection, on October 2, 1908, I could introduce only $1\frac{1}{2}$ drachms of the paste. There had been no discharge for several weeks. The patient had gained weight and strength and resumed his occupation. Through the greater part of the autumn and winter the sinus continued to discharge daily a very small amount of a thin cloudy serum, when suddenly one day there was quite a large discharge which he described as pus. He then consulted Dr. G. R. Higgins in whose care I had left him on my return to Philadelphia. Dr. Higgins gave him a few injections of the paste, and then upon the patient's request wrote to Dr. Beck and sent him to Chicago. He remained in Dr. Beck's hospital only a few weeks, where he received a few more injections with some improvement and was promised a cure. He, however, decided to return home when he continued to improve. When I returned to Bar Harbor in June, 1909, I found the sinus almost closed and was able to inject only a few minims of the paste. The area around the opposite red spot, however, was slightly soft and fluctuating. I opened it and squeezed out a few minims of occluded paste. The tissues below and around the old cavity areas were firm and contracted. The wound I made soon healed. I cauterized the opening of the old sinus which promptly closed and there has been no sign of trouble since. I believe the discharge he had in the winter was not pus but the remains of occluded paste, and this illustrates the wisdom of favoring the

FIG. 1.



CASE V.—A, Anterior fistulous opening. B, Posterior fistulous opening.

escape of paste in such cases. It probably acts as an irritant if allowed to remain any length of time.

CASE IV.—Tuberculous hip-joint disease with persisting sinus on outer aspect of left thigh of three years' duration, in a little girl of 8 years who had had two radical operations. This case was referred to me December 16, 1908. The radiograph showed a network of sinuses around the ankylosed joint and extending on to the sacrum and marked destruction of bone tissue and absorption around the head of the femur and the acetabulum. This case was given nine injections at intervals of four to seven days. She discarded her crutches after the third injection, her general health improved and she gained rapidly in weight. The sinus had closed February 8 and remained so until a short time ago. In August I received a letter from her mother stating the child had been feeling badly for a few weeks and the sinus had opened, discharging some of the paste and a small quantity of pus. She had two injections in December, 1909, and the sinuses now appear to be permanently closed.

CASE V.—Tuberculous disease of hip-joint in a boy of 7 years, referred to me by Dr. F. L. Ober of North East Harbor, Me., on July 19, 1909, for a bismuth-vaseline radiograph for diagnostic purposes. There were two sinuses, one in the groin and the other posteriorly about two inches above the great trochanter. I injected both these sinuses under firm pressure and made the radiograph which I herewith present for your inspection (Fig. 1). It is very like the picture of the previous case and shows extensive disease around the head of the bone. In a letter dated September 9, 1909, the father says that the boy went to the Maine General Hospital in Portland in September, 1904, and the following year he was operated upon in the Bar Harbor Hospital. The wound has never healed properly and has been discharging more or less ever since. In 1906, another place was opened which has also not entirely healed. Since the injection of the paste there has been very little discharge of pus, only a slight moisture around the sinuses. His health has improved and he seems to be gaining weight and has given up the use of his crutches.

The technic and rules to be observed in making these injections are very simple. The paste consists of bismuth subni-

trate 33 per cent. and vaseline 67 per cent. The bismuth should be slowly stirred into the vaseline while hot, but not boiling. When cool this mixture forms a thick soft paste. Just before using, it should be heated and thoroughly stirred until it becomes thin enough to be drawn into a suitable syringe. Dr. Beck recommends a syringe which I show you. Care should be taken that no water should enter the sinus, which requires no treatment other than washing its orifice with 95 per cent. alcohol. It is not necessary to dry out the sinus with gauze. The nozzle of the syringe should be placed firmly against the opening and under moderate pressure the paste is slowly forced in until the patient begins to complain. A pledget of gauze is then placed against the opening and an ice bag applied for a short time. The patient should remain quiet for a few hours. An anæsthetic is not required as the injections are usually painless.

Various theories have been advanced to explain the results which follow this method. Beck believes that the action of bismuth subnitrate is bactericidal, chemotactic and astringent, and says that he investigated its bactericidal action by systematic examination of the secretions from suppurating sinuses while under treatment and invariably found a continuous decrease in the number of organisms and in many cases their final disappearance. Tubercle bacilli were no exception to the rule. He goes on to say: "Whether the bismuth destroys the bacilli by its chemical action or whether its presence acts as a chemotactic, we have not yet determined, although the evidence predominates that its chemotactic property accounts for the destruction of the micro-organisms." He also believes that the mechanical action of the bismuth paste is a prominent factor in the healing process. The diseased walls are separated, bringing them in contact with a substance in itself bactericidal and stimulating. Another factor is the well-known influence of the X-rays upon tuberculous disease in the presence of bismuth vaseline, but he admits that it can play only a secondary part in the healing, since excellent results have been obtained without the aid of the X-rays.

For obvious reasons this method is not applicable in cases of biliary or pancreatic fistulæ or in sinuses communicating with the cranial cavity or hollow viscera. There are cases in which the bismuth plug may by pressure on a vital organ produce unpleasant symptoms. Neighboring large veins may be so altered by the suppurative process as to permit the injection to break through the thin and diseased wall, and in this way enter the circulation, causing serious consequences. By animal experiments he demonstrated that the bismuth paste injected into the axilla caused death within two minutes, due to the entrance of the paste into the axillary vein, and finally blocking the branches of the pulmonary artery.

Toxic effects from the use of large quantities of the paste have been observed in a few cases. The symptoms are those of nitrite poisoning so well known to the röntgenologist in the early work of bismuth feeding and injections for diagnostic purposes. When used with a moderate degree of caution there is no danger. Injections up to 100 Grams of the 33 per cent. paste produce no toxic effect.

Among the important conclusions with which Beck closes his paper are the following: Tuberculous sinuses, fistulous tracts, abscess cavities, including empyema, can be cured by injecting them with a 33 per cent. bismuth-vaseline paste. The formation of sinuses and fistulous tracts may be prevented by opening cold abscesses, evacuating the fluid, and at once injecting a quantity (not exceeding 300 Grams) of 10 per cent. bismuth-vaseline paste and not sealing the opening. While these injections are effective in all suppurative sinuses and cavities, those of tuberculous origin respond to them more readily. This method of treatment is applicable to the suppurative accessory sinuses of the head.

DR. G. G. DAVIS said that his first experience with regard to this method of treatment was caused by his trying Moorhoff's paste for caries of bones in which iodoform, spermaceti wax, and oil of sesame was used. He was not successful in getting primary healing, but they did so well that he used the iodoform wax injection in other tuberculous and discharging bone cases with

very satisfactory results. Since the report by Dr. Beck of his bismuth process he had used both substances. The results certainly are very good. Not very long ago he had several cases of discharging abscess in the wards of the Orthopædic Hospital; they were all cases of Pott's disease or coxalgia, and when he failed in other methods of treatment he had been able to cure them by means of these injections. If, for instance, in a psoas abscess, it does not heal after aspiration and injection of the iodoform emulsion, he does not hesitate to open, drain, and treat the resulting sinuses by means of bismuth injections. Likewise it is of use in osteomyelitic conditions, and has entirely revolutionized the treatment of these bony sinuses because from being the most intractable they are now frequently quite amenable to treatment. Of course, there are some failures.

As to the danger of poisoning, when it comes to coxalgias and ordinary bone cases usually there is not enough of the material used to render the danger of poisoning at all imminent, but when it comes to large cavities like empyemas, etc., in which the amount used has been very large, then the danger of poisoning is greater, and certainly deaths have occurred from it. If the symptoms of poisoning do develop it is recommended that a catheter be introduced into the sinus or wound, and hot olive oil injected, thereby liquefying the bismuth and removing it from the cavity immediately, thus preventing any further increase in the poisonous symptoms by further absorption.

DR. JOHN B. SHOBER, in closing, said, although the technic of this method is very simple, it will fail if not properly carried out. The paste should be as warm as can be borne, so that it will run easily, and sufficient force should be used to drive it throughout the entire network of the tract. Unless this is accomplished there will remain foci of disease, unreached by the paste, which will continue to cause trouble. The surgeon should himself make these injections and not leave it to the inexperienced hospital interne and never to the trained nurse.

TOURNIQUET FOR THE CONTROL OF HEMORRHAGE FROM THE SCALP DURING OSTEOPLASTIC RESECTION OF THE SKULL.

BY ALFRED C. WOOD, M.D.,

OF PHILADELPHIA,

Assistant Professor of Surgery, University of Pennsylvania; Surgeon to the Hospital of the University of Pennsylvania and to the Philadelphia, St. Timothy's and Howard Hospitals.

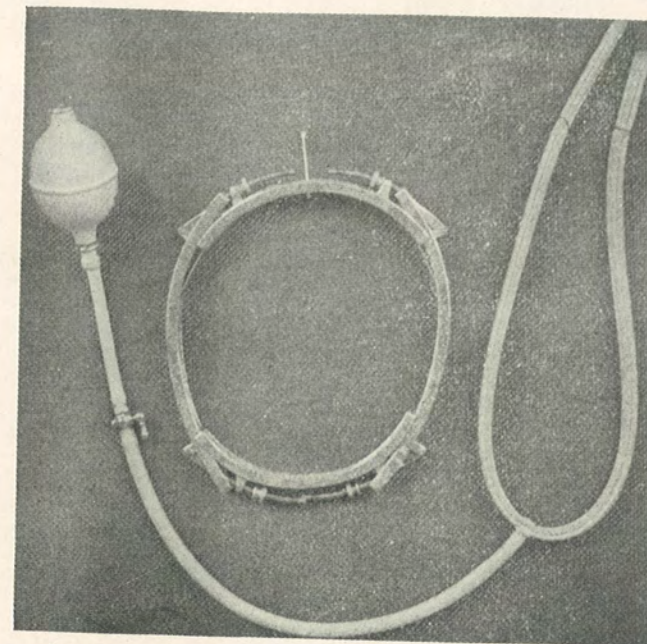
THE scalp receives a larger supply of blood than any other portion of the skin of equal area. The arrangement of its vessels is peculiar. Running in the dense connective tissue layer, which, by its closely disposed perpendicular and oblique fibres, binds the skin firmly to the aponeurosis of the external oblique, they are unable to contract and retract when cut as do vessels under other conditions. These facts explain the free and persistent hemorrhage from wounds of the scalp. Under ordinary circumstances the difficulty is overcome by the application of sutures or pressure, or both.

The introduction of osteoplastic resection of the skull has given a fresh importance to the problem of bleeding from the scalp vessels. The incision, several inches in length, in many cases, and the operation being necessarily prolonged frequently, there is a loss of blood which is always serious, and may even be the cause of a fatal termination. In common with others, I presume, who have been engaged in this line of work, I have endeavored to find a satisfactory method of preventing this apparently unnecessary hemorrhage. The use of the elastic band never appealed to me. On account of the oval shape of the head, in order to be at all effective it must be applied so firmly that excessive pressure is made on the forehead and occiput, while in the temporal region, unless reinforced by inserting a pad under the band, it is insufficient

to control the vessels. The pressure forceps of Howzell and others are so much in the way of the steps that follow the scalp incision that they are but little used. I have not employed the interlocking mass suture of Heidenhain, nor the modification of Kredel, as neither seemed to me practical.

On account of the shape of the head, the irregularity of the outline of the fronto-occipital circumference of the skull, and especially in view of the receding temporal fossa, where pressure is especially important, as the base of the flap in almost all operations upon the cerebrum is at this point, an inflatable rubber tube appeared desirable. In order that the pressure might be uniform and not unduly localized to the forehead and occiput, the need of some form of external frame to form a resistance against which the tube could act was evident. Without the latter, the effect of the tube would practically be the same as the elastic tourniquet. With these thoughts in mind, I had constructed an inflatable rubber tube long enough to encircle the head and an adjustable metal band, into which the tube fits. At the centre of the inflatable tube is joined a piece of ordinary tubing through which the former may be distended. The band consists of four segments,—a frontal, an occipital and a right and left temporal—which, when joined together, have the outline of the fronto-occipital circumference of the skull, and, being adjustable, may be adapted to any head of ordinary size or shape. The temporal segments are 1.4 cm. ($\frac{9}{16}$ in.) and the frontal and occipital portions 1.6 cm. (about $\frac{5}{8}$ in.) in width; all are 0.6 cm. ($\frac{1}{4}$ in.) in thickness. The band is held together by hinged arms, upon which a thread has been cut, attached to the ends of the temporal sections and passing through eyes set on the ends of the frontal and occipital sections respectively. The size of the band is regulated by thumb-screws operating on the arms. The joints have been so constructed that the inflatable tube is fully supported in every possible adjustment of the band. At the middle of the frontal segment a hole is provided through which the inflating tube projects. Any other position may be chosen, but this seemed the most available. Inflation is secured

FIG. 1.



Showing the segmented metal head-band, inflatable rubber tube, inflating tube, 3-way cock, rubber inflating bulb (Wood).

by means of an atomizer bulb, joined to the inflating tube by a three-way cock, by means of which the air is retained in the tourniquet or is instantly released. Instead of this cock, the air may be controlled by compressing the inflating tube by hæmostatic forceps. Both the tube and the metal band may be boiled, or immersed in the usual antiseptic solutions. In either case, it is desirable to clamp the open end of the tube in order to prevent water from entering.

To apply the tourniquet, (1) the head band is adjusted somewhat larger than the head; (2) the rubber tube is placed inside of the band; (3) a piece of gauze bandage, two inches wide, doubled upon itself so as to be one inch wide and a little more than three feet long, is carried across the head, the middle being about at the vertex, so placed as not to encroach upon the operative field; (4) the tourniquet is slipped on the head so that the frontal portion is in contact with the eyebrows and the posterior part just below the occipital protuberance; (5) the ends of the bandage are brought together and tied. The thumb-screws are then adjusted to make the metal band set closely to the head, but without causing pressure.

Directions as to those details connected with the application of the apparatus that must conform to a most rigid antiseptic technic have been purposely omitted, as each operator can best adapt these in accordance with his particular methods.

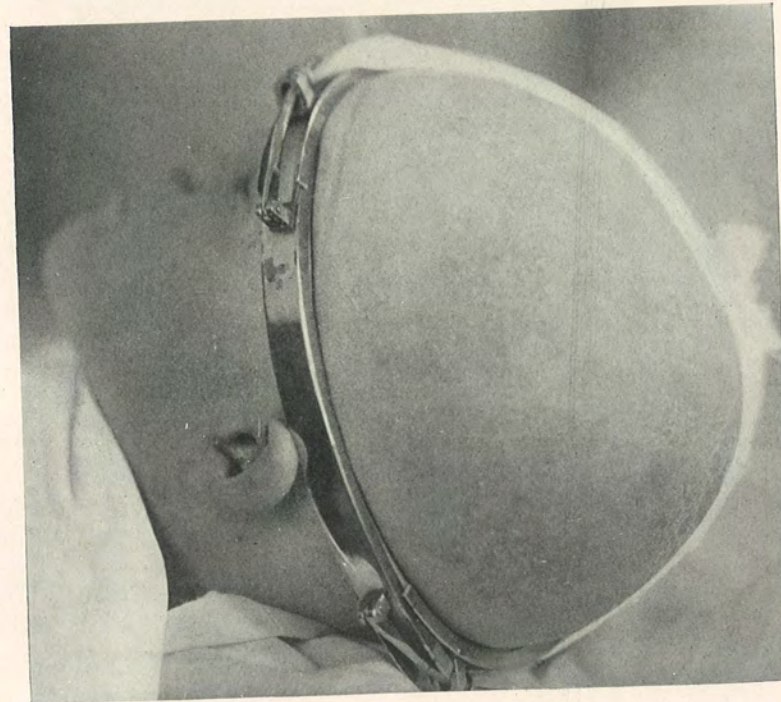
The tube is inflated by a rubber hand bulb which is advantageously operated by the anæsthetizer, although another assistant may attend to this detail. The exact amount of pressure necessary may be ascertained by placing a finger upon one of the branches of the temporal artery above the tourniquet. When the pulsation has ceased the proper tension has been obtained. Or it may be estimated with sufficient accuracy by noting the resistance to compression of the bulb. As the tube is inflated by the ordinary atomizer bulb, operated by hand, there is no danger of applying injurious pressure at any point. On the other hand, as the tube is equally supported throughout its circumference, the compression is uniform

FIG. 2.



Tourniquet applied. The bulb is placed on the chest for illustration. In use it is allowed to drop toward the floor.

FIG. 3.



Side view.

at every point, however irregular the outline of the skull. In common with all other tourniquets that I have used, unless supported it has a tendency to roll over the eyebrows during the operative manipulations and rest on the eyes. This requires a re-adjustment, which is both time consuming and annoying. Hence the necessity of counteracting this tendency by a bandage carried across the head before the tourniquet is applied, as already described.

I have used an apparatus of this sort for several years, and in the present form for the past three years. When the tourniquet has been adjusted as above described, I have been able to complete the osteoplastic exposure of the brain with whatever other details were required without the necessity of clamping a single scalp vessel. I allow the bulb to remain attached to the tube during the operation, and if any oozing from the scalp is observed, the anæsthetizer is requested to compress the bulb once or twice, which is always effective in arresting the flow.

An objection to the use of the tourniquet in cases with severe intracranial pressure has been raised by Archibald, apparently on theoretical grounds. He thinks it possible that in such cases this circular compression might increase the cerebral pressure by preventing the escape of blood through the emissary veins to the scalp, thence to the jugulars, which it is believed may take place. I have employed this tourniquet in two cases showing extreme cerebral tension within a few months with entire satisfaction in every respect. However, this tourniquet is so constructed that the pressure is instantly released by turning the cock, and is almost as quickly restored by compressing the bulb. The inflation and deflation are not only accomplished quickly but also without the least disturbance of the patient's head, the surrounding aseptic sheets or even the progress of the operation. It is thus a very simple matter to interrupt the pressure from time to time, if the operator desires to do so.

My attention has been called recently to the fact that Cushing described in 1904 his pneumatic tourniquet. While I was

not familiar with his apparatus, I desire to give him full credit for priority. It may be noted, however, that this instrument is based upon a different principle.

The tourniquet above described is the only one with which I am familiar that provides a means of making uniform pressure throughout the entire circumference of the head, adapting itself to all irregularities of surface, and that does not make undue or injurious pressure at any point. As a means of controlling hemorrhage from the scalp incision during prolonged operations, I believe it will be found superior to any form of circular compression clamp or scalp suture so far devised.

STATED MEETING, HELD MARCH 7, 1910

The President, DR. ROBERT G. LECONTE, in the Chair.

FRACTURE OF THE PATELLA TREATED BY SUBCUTANEOUS PURSE-STRING SUTURE.

DR. JOHN B. ROBERTS presented a man to demonstrate the result of the treatment of a fracture of the patella by a subcutaneous purse-string suture (Fig. 1).

He said that two or three times in discussions in regard to the suturing of the patella he had mentioned this method, but never found any one to believe in it but himself, so he had brought this man to prove how satisfactory it is both to the patient and to the operator. It can be done without general anæsthesia, although it is better to give ether, because then the muscles are fully relaxed, and one can press the fragments more closely together with the fingers. By rubbing them together when they are in apposition the edges of the capsule may be displaced from between the fragments. After getting them together, put the wire or string around the bone and then have a skiagraph taken. The apposition is apt to be a little imperfect, but the union becomes so good that for all practical purposes it is as good as the result obtained by the open operation.

This is not Barker's operation, for he passed the ligature around the bone in the sagittal plane, going through the joint and back under the skin over the top of the patella and tied. The method described is a purse-string suture in the coronal plane, going around the bone by passing through the ligamentum patellæ, catching the tendinomuscular tissues on both sides, and traversing the muscle just above the bone. It thus, when tied, draws the fragments together. It is satisfactory for a man who does not like to give his patient too great a risk, and who is not afraid of aseptic subcutaneous work or of the string breaking.

It is wise to make four punctures through the skin and deep fasciæ at the points of exit of the needle, so that the ligature when tied may sink into the muscular structures and closely grasp

the adjusted patellar fragments. The leg should be kept extended for three or four weeks. Then the ligature is removed by cutting the knot with fine pointed scissors and withdrawn. Later careful passive motion is made. Dr. Roberts found the method satisfactory for a number of years past. It is described in Jacobson's operative surgery as used by the speaker.

DR. JOHN B. DEEVER said that he wished particularly to argue against the Barker operation in fractures of the patella. It is no better than a Malgaigne hook or plaster of Paris. If one aims to have bony union, the fragments of the capsule must be gotten rid of, and that is possible only by open operation which allows inspection and exact manipulation.

FIG. 1.

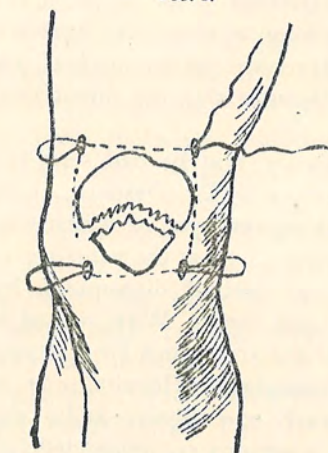


Diagram of purse-string method of treating transverse fracture of the patella.

DR. HENRY R. WHARTON said that the operation done by Dr. Roberts is to his mind practically a modification of Barker's operation, which enjoyed a certain amount of popularity years ago, but which is seldom done at the present time. His reason for feeling that these operations are not satisfactory is that his experience in opening the knee-joint in operating on fractures of the patella has shown him that in many cases the lower fragment is so drawn out of place that the articular surface is often turned upwards so that it comes in contact with the fractured surface of the upper fragment, and he also does not believe very

close approximation can be got in the presence of a large blood-clot, which is another objection to this method of operation. Excepting in such a special case as the one presented, it is better to do the open operation for bringing the fragments into close approximation.

EXTENSIVE ANGIOMA OF THE UPPER EXTREMITY; VARICOSE VEINS SIMULATING A FEMORAL HERNIA.

Cases of the affections named were presented by DR. DUNCAN L. DESPARD.

DR. WILLIAM J. TAYLOR said that some years ago he reported an instance of a woman who had worn a truss for a number of years for what she had been told was a femoral hernia. She had no varicose veins anywhere. He operated on her and found varicose veins at the femoral ring. He ligated them and she did very well until a gastric ulcer set up mischief, and she finally died of a clot which he thought was the direct result of the gastric ulcer.

DR. JOHN H. GIBBON said he had seen two other cases, in addition to the one shown by Dr. Despard, of dilated veins in the femoral and inguinal regions, one of which was sent to the hospital as a case of hernia. Unless the veins were growing or were giving rise to a great deal of discomfort, he would not feel inclined to operate upon them. With regard to the case of the extensive angioma of the arm which Dr. Despard had shown, this patient was in the Pennsylvania Hospital nine years ago when the condition was not nearly so extensive, and at that time Dr. Harte tried the hot-water injections recommended by Wyeth. One of the interesting features in this case is the marked atrophy of the bones of the arm.

DR. HENRY R. WHARTON recalled a case at the Children's Hospital some years ago. The patient, an infant about one year of age, had an extensive angioma involving the shoulder and extending out into the pectoral muscles, which he attacked with the galvanocautery. A very fine Paquelin point was made and applied, heated, at a number of points; the case was under treatment for several months and finally got well. Of course, if this had been allowed to go without treatment, it would probably have developed into a condition much like that of Dr. Despard's patient.

DR. A. P. C. ASHHURST, referring to the case of angioma, said that nearly four years ago he showed before the Academy a 12-year-old girl with an angioma quite as extensive in area but not nearly so large as this boy's, and the Fellows thought then that the prognosis was rather gloomy; but he had hunted her up recently and found that she is much better. The swelling is not so great when the arm hangs down, and she has developed very well, although the upper extremity is two inches shorter than the other one. Therefore, in the light of the improvement in his own case, he should give a more favorable prognosis in Dr. Despard's case and should be inclined to leave it absolutely alone. The boy says he can use this hand as well as the normal one, and experiences no handicap at his work.

VOLVULUS OF THE SIGMOID.

DR. EDWARD B. HODGE said that aside from the comparative rarity of sigmoid volvulus, this case is of interest from its history and from the size of the sigmoid.

J. K., aged 60 years, male, was admitted to the Presbyterian Hospital in November, 1909, on the fifth day of the attack. He had always been constipated, except for a few months six years ago, and again four years ago, when he had three to four very loose stools a day without pain. Two years ago he began to have attacks of partial obstruction three to four times a year. For two days there would be increasing tympanitis, no passage of flatus, slight colicky pain in left iliac fossa, radiating toward the umbilicus, and discharge of watery fluid from the rectum several times in the twenty-four hours. Then he would take a purge, and obtain relief after passage of very large, soft stool and much flatus; appetite good always.

Present attack was identical for two days, except that anorexia was present. There was no result from the usual purge on the third day. The distention became worse, with pain present but not increasing. On the fourth day he consulted his physician, who could find nothing pathological in the abdomen, and ordered a dose of castor oil. This was without effect, and the distention steadily increased. On the fifth day his doctor gave him a two-quart enema, which was retained. Two hours later this was repeated, with the same result. Later another injection was returned as fast as given. Vomiting, which had been absent, now began, and he was brought to the hospital at 8 P.M.

His general condition was fair. Temperature 99.8°, pulse 120, respiration 24. There were extreme symmetrical distention, tense abdominal walls, through which nothing could be felt; no rigidity; slight general tenderness and dullness in the flanks, particularly the left. Peristalsis was absent. Rectal examination showed nothing but a much dilated rectum.

Left inguinal colostomy incision was made under ether. Slightly distended small intestine and descending colon presented. The obstruction was felt at the pelvic brim, and an enormously dilated sigmoid was lifted out. This was so large and the mesentery so long that the one loop of bowel had caused most of the distention. It extended to the liver and ensiform cartilage. The bowel was twisted from right to left through 360°. The twist was released, and bowel wall and mesentery found in good condition. There were no signs of adhesions or inflammation. With the loop hanging well over the edge of the table, a large quantity of gas and fluid was evacuated by incision. This was closed in the usual manner and the sigmoid returned to its proper place. The abdominal wall was closed by layer sutures without drainage. The patient's general condition was not thought good enough to warrant any procedures to prevent recurrence of the attack.

The patient made a smooth recovery and has been in excellent condition ever since.

Volvulus is generally credited with 3 to 4 per cent. of intestinal obstructions. Recent observations tend to give a higher percentage. While the present is the only instance of volvulus recorded at the Presbyterian Hospital in the last ten years among 61 intestinal obstructions, 57 operations at the Pennsylvania Hospital in the last five years give 7 of volvulus, 3 being of the sigmoid. This case is a fairly typical example of the recurring or subacute type. Careful attention to the history will often show symptoms extending over a term of years. This patient had six or eight attacks of partial twisting in two years. One of Bloodgood's¹ cases had thirty-two attacks in sixteen years.

The important factors in etiology seem to be: (1) constipation; (2) long mesentery; (3) approximation of the foot-points of the loop; (4) adhesions; (5) age, 40 to 60; (6) male sex, 80 per cent. It is generally held that the drag of a sigmoid overloaded with gas and feces elongates the mesentery of its pelvic

¹ ANNALS OF SURGERY, 1909, xlix, 161.

portion, and so favors twisting. If, in addition, the foot-points of the loop are close together, volvulus is still more liable. The size and weight of these distended loops are hard to believe until seen. In his case he believed that most of the first two enemata passed into the sigmoid and were retained there, the weight then serving to increase the twist and make tighter the obstruction.

Why the proportion of male to female should be 4 to 1 is hard to understand, if constipation plays much of a rôle. Perhaps an elongated mesentery on the pelvic sigmoid is more frequent in the male, though the speaker could find no studies throwing any light on this or any other anatomic difference in the sexes.

High enemata in the knee-chest position will often relieve partial sigmoid volvulus. This failing, laparotomy, with untwisting of the volvulus and evacuation of the bowel by a rectal tube or incision, is demanded. To prevent recurrence, said to be usual, the sigmoid may be sutured to the lateral pelvis wall, or the mesentery folded on itself parallel to the bowel. Resection of the loop will be required for gangrene.

ULTIMATE RESULT OF EXCISION OF THE ELBOW-JOINT.

Dr. H. R. WHARTON presented a woman, aged 50 years, whose left elbow-joint he excised fifteen years ago, for disability resulting from a fracture of the condyles and posterior dislocation of the bones of the forearm at the elbow of some months' standing. The patient did well after the operation and in a few months had good functional result. The functional result after fifteen years is good.

Dr. Wharton added that the principal point in obtaining a good result in excision of the elbow-joint is to remove the ends of the bones freely, and to begin passive motion not later than the third week. In excising the elbow-joint he also endeavored to retain the attachment of the triceps muscle to the ulna so that the patient will have more than gravity extension of the forearm. He divides the tendon of the triceps and divides the attachment of the triceps to the olecranon and periosteum from the bone to a point below the bone section, and finally after the excision of the bones is completed unites the severed tendon by sutures. This procedure seems to give the patient better power of extension of the forearm.

DR. G. G. DAVIS, in commenting on excisions at the elbow, called attention to one point in the structure of the part. In fracture of the patella, the amount of separation is practically dependent upon the extent of the tear in the tissues on each side of the patella. The olecranon in the upper extremity is the homologue of the patella, and the olecranon, like the patella, has a fascia extending to the sides, which in a fracture of the olecranon will tend to hold it in place provided it is not too widely torn. The internal condyle lies close to the olecranon and between them runs the ulnar nerve and the fascia. There is a distinct fascia going from the side of the olecranon continuous with the tendon of the triceps and the internal condyle, but the distance is so short and this fascia so loose that it does not bear an important part in resections. When it comes to the outer surface of the joint from the external condyle to the side of the olecranon is a considerable distance, and if one traces down the tendon of the triceps he finds it inserts not only into the olecranon but passes as a broad sheet between the external condyle and the olecranon to be inserted into the upper one-fourth or one-third of the posterior surface of the radius, hence it is that when this is not divided in resections of the elbow-joint one frequently gets good results. It is obvious that one must expect a certain amount of weakening in the power, because an inch to an inch and a half of bone has been removed.

DR. JOHN H. JOPSON said that he had recently practised a method of preserving the attachment of the triceps in excision of the elbow, which he saw described some time since. It consists in sawing through the olecranon transversely, about one and a half inches below its tip, and turning the detached portion upward, with the tendon still attached. An excellent exposure of the joint is thus obtained. In traumatic cases where the olecranon is uninjured there is no necessity for removing any portion of it. In tuberculous cases the under surface if diseased can be removed by sawing off a slice. After concluding the operation of excision, the olecranon is dropped back and wired to the ulna.

PNEUMOCOCCIC PERITONITIS.

DR. HENRY R. WHARTON presented a girl, aged 8 years, who was admitted to the Presbyterian Hospital May 22, 1907, with the history that one week before her admission she suffered from

abdominal pain, fever, and cough. She was seen by her physician, Dr. Ellinger, the day before her admission, who found her with a high temperature, pneumonia of the right lung, and a tender and distended abdomen.

When examined after admission her temperature was 103°, pulse 140, respiration 40. There was pneumonia of the right lung. The abdomen was moderately distended, rigid, and tender on pressure.

Under ether anæsthesia an incision was made over the region of the appendix, and when the peritoneum was opened a quantity of thick, yellow, odorless pus escaped. This purulent fluid seemed freely distributed through the abdomen and the pelvis. The appendix was normal in appearance; it was removed. Gauze and rubber drainage was introduced into the abdomen and into the pelvis, and the wound was partially closed by sutures.

An examination of the pus found at the time of opening the abdomen showed a pure culture of pneumococcus.

The day following the operation pneumonia of the left lung developed. The patient was critically ill for some weeks, and there was free discharge from the abdominal incision. The patient finally recovered and was discharged from the hospital in August. At the present time she is in good health.

Dr. Wharton remarked that pneumococcic peritonitis may exist as a primary or secondary affection. In the former case it is due to the primary idiopathic infection of the peritoneum by the pneumococcus; and in the latter arises from the infection of the peritoneum by the same organism in the course of pneumonia, pleurisy, or meningitis. A study of 74 cases of this affection by Savestre and Aubertin showed that the disease was primary, that is, the chief or only focus of pneumococcic infection, in 47 cases. In 140 cases of peritonitis examined bacteriologically, Netter found this form of infection only in two cases. Rollerston considers it a comparatively rare disease, although a number of cases have been reported by individual observers. Jansen has collected 106 cases of pneumococcic peritonitis.

Primary pneumococcic peritonitis is considered by Comly to be more frequent in children than in adults. Rollerston considers the disease primary in about one-half of the cases observed. All observers agree as to the greater frequency of the disease in childhood. Under 15 years of age the disease is much more

commonly observed in girls than boys; according to Armand and Bowen, who collected 91 cases, the proportion was 3 to 1; while after this age its occurrence was equal in the two sexes.

When secondary, the disease may follow pneumonia, pleurisy, pneumococci gastro-enteritis, or appendicitis. The comparative rarity of the development of pneumococcic peritonitis in pneumonia is well shown by Rollerston's statistics: in 4454 cases of pneumonia, peritonitis was found only in 11 of the fatal cases, 0.025 per cent. The same authority points out the following channels through which the bacteria reach the peritoneum: (1) the blood stream; (2) stomach, intestines, and appendix; (3) pleura, through the diaphragm; (4) the Fallopian tubes.

While the disease may be primary or secondary, it is probable that hæmatogenic infection plays a most important part in its development.

Pneumococcic infection of other serous membranes may occur in addition to that of the peritoneum, especially in young children. The onset of the disease is sudden. The symptoms are abdominal pain, fever, and vomiting; these symptoms are so similar to those of acute appendicitis that the conditions are likely to be confounded. The acute symptoms may subside or become chronic, and the condition may resemble typhoid fever or tubercular peritonitis. Nutall describes two types of the affection: the acute, fulminating, diffused form, which is often fatal; and a form in which the onset is acute, but the progress is slow, which leads to the formation of a localized abscess. The lower abdomen is usually involved, and in a large majority of the cases this purulent collection becomes encysted, and the abscess occurs in the region of the umbilicus and tends to point. According to Armand and Bowen recovery followed in 86 per cent. of encysted cases and only in 14 per cent. of cases presenting the diffused form of the disease.

In view of the good results obtained in peritonitis by incision and drainage, it would seem wise to subject cases of pneumococcic peritonitis as early as possible to the same treatment. In the diffused cases, in addition to incision and drainage, the Murphy method should be employed. In the encysted cases, incision and drainage only would be required. Nutall recommends in the diffused form of this disease, if the diagnosis is made sufficiently early, the use of antipneumococcic serum and a trial of the vaccine method of treatment.

VALUE OF TENOTOMY IN SOME CASES OF FRACTURE OF TIBIA AND FIBULA.

DR. HENRY R. WHARTON said that in February, 1910, he was asked to see a lady in a town about 40 miles from Philadelphia, who had sustained a fracture of the tibia and fibula near the ankle-joint, in which it was found difficult to correct the deformity. The injury had occurred ten days before he saw her.

When he examined the patient, he found the limb much swollen, the foot flexed and drawn backward, simulating the deformity of a posterior dislocation of the ankle, and a marked projection of the lower end of the tibia above the ankle-joint.

The limb had been treated in a fracture-box, and there was a gangrenous spot the size of a dollar over the point of the heel. The deformity had been reduced on several occasions, but each time it had recurred.

She was sent to the Presbyterian Hospital the following day, and a skiagraph taken, which showed a fracture of the internal malleolus, a fracture of the lower end of the fibula, and a posterior displacement of the astragalus, which carried backward with it the foot and the fragments of the tibia and fibula.

After being etherized, it was found that by extension and manipulation only a partial correction of the deformity could be obtained. He therefore divided the tendo-Achillis subcutaneously, and was then able to reduce the fragments and correct the deformity completely. The limb was held in the corrected position and a plaster-of-Paris bandage applied, with provision for trapping over the gangrenous spot in the heel.

The patient did well after this, and was discharged from the hospital in eight weeks, with firm union and the bones in good position; she walked well and had normal motion at the ankle-joint.

Dr. Wharton said many cases of fracture of the tibia and fibula occur in the location of the one just reported, in which the deformity is not very marked; but occasionally the deformity described above is met with. It is possible that in such cases there has been extensive laceration of the anterior tibial-tarsal ligament and lateral ligaments, in addition to the injury of the bones.

He had had in his own practice four or five cases of fracture

of the tibia and fibula near the ankle-joint, where it was impossible to correct the deformity by ordinary methods, in which he had resorted to tenotomy of the tendo-Achillis to assist in the correction of the deformity. In all of these cases the result was eminently satisfactory, both as to the correction of the deformity and the subsequent use of the limb.

DR. G. G. DAVIS remarked that when the leg bones are broken, usually the upper fragment projects forward and the lower fragment is carried backward. The preponderance of muscles is posteriorly and renders this displacement marked and persistent. If one eliminates the muscles of the calf we have the muscles practically balanced. The muscles of the leg are practically of four sets, an anterior extensor set, comprising the anterior tibial, the extensor hallucis, and the extensor communis, and a posterior set, the posterior tibial and flexors of the toes and of the big toe; three abductors; the peronei muscles are on the outside and anteriorly and hardly take much part in flexion and extension, but the muscles of the calf, the gastrocnemius, soleus, and plantaris, have nothing to oppose them, therefore after dividing the tendo-Achillis there remain three muscles on the front and three on the back. The first thing to do in treating these displacements is to get rid of the action of these calf muscles, and by placing the leg in the Potts position (flexed on its outside) it is often easy to bring the foot into place. The use of adhesive plaster extension is likewise successful in some cases, but in a certain proportion of cases both these methods will fail, and then one is confronted with two propositions, one being to open up the fracture and bring the bones in apposition, wiring or fastening the fragments in place, and the other is the division of the tendo-Achillis. Of course, the division of the tendo-Achillis is the less dangerous of the two and it is very efficient. He had employed it for many years, but the question has always remained in his mind as to whether or not the division is accompanied by a permanent weakening of the functions of that limb. If one operates by open section and deliberately replaces the bones, fastening them with wire, the leg is practically normal again. If one divides the tendo-Achillis, when the patient gets well his bones unite and he has a good looking limb, but to what extent do these calf muscles regain their original strength?

DR. ROBERT G. LECONTE agreed with Dr. Wharton that in

the type of fracture which he showed, division of the tendo-Achillis is the expedient form of treatment. He had done it three or four times with good after results. There is always some atrophy of the calf muscles following, as there is after a traumatic rupture. In two cases he had seen of rupture of the tendo-Achillis from muscular violence, the limb in each instance has recovered perfectly from a stand-point of usefulness, although never coming back quite to the original measurements; so much so, that the patients are unaware now on which side the rupture occurred.

CALCULOUS CHOLECYSTITIS.

DR. JOHN H. GIRVIN reported the following cases:

CASE I.—A woman, age 40 years. Healthy until age of 17, when her child was born. Was never well after that. Seven years ago was operated for pyosalpingitis.

Present Illness.—Seven months ago had a severe attack of pain in epigastrium. Recovered in two weeks but soreness in right side continued for several weeks. No jaundice. Three weeks before admission a similar attack associated with severe vomiting, which improved under diet and treatment but did not clear up. This became much worse two days before admission to Presbyterian Hospital on January 12, 1910, at which time she was suffering severe pain. Had inspiratory catch. Upper abdomen very rigid and exquisitely tender. Three days later the pain had disappeared but some tenderness and rigidity remained, which gradually diminished until it was possible to outline a distended and tender gall-bladder.

Operation (January 22, 1910).—Vertical incision through edge of muscle. Gall-bladder exposed only after breaking up many adhesions. Incised and evacuated a clear thin fluid like bile, followed by thick creamy pus. At the beginning of the cystic duct was found a single stone the size of an ordinary marble which was removed with a curette. Uneventful recovery.

CASE II.—Woman, aged 37. Two years ago after typhoid had a dull heavy pain in back which became severe and cramp-like and moved along the right costal margin to the region of the gall-bladder, where it became very severe, causing vomiting. Next day all pain gone but very sore and weak. Six or eight months later had a similar attack but more severe and longer. Up to admission patient has had five such attacks—each more

severe and at shorter intervals. Last attack three weeks before admission. Never jaundiced; bowels moving by medicine since last attack and apparently normal.

When admitted there was no marked tenderness over gall-bladder region, and the gall-bladder could not be palpated.

Operation (February 5, 1910).—Vertical incision at edge of rectus. Liver seems freely movable downward, and under the edge of liver, bound up in a dense mass of old adhesions, was found a small thick-walled gall-bladder, to the lower edge of which was a dense adhesion to the bowel which resembled a fistulous tract but contained no opening. This was separated and only the necessary adhesions broken up. The gall-bladder was opened and a culture made of the clear non-purulent fluid. This showed a pure culture of the typhoid bacillus. A stone exactly like that in the previous case was removed from the same locality. Drainage tube inserted and an attempt made to invert edges, but this was very difficult on account of the thick walls of the gall-bladder and its very friable condition. Packing removed and a small gauze drain inserted to the region of the intestinal adhesion. Recovery uneventful but for bronchial irritation for first three or four days—temperature 101°.

CASE III.—Woman, aged 59 years. About two years ago struck her side on edge of table and was very sore for some time. After this, began to notice a swelling in region of the gall-bladder which was almost constantly sore. Had symptoms of indigestion but no vomiting and no distinct jaundice, although there is some cachexia. Her general health seemed to fail and she became so weak that she has been in bed for past three months. Came to city about two weeks ago and has since been under the care of Dr. Somerkamp, who made the diagnosis of gall-bladder disease.

Operation (January 5, 1910).—Incision was made along right rectus. Gall-bladder found enlarged and walls thickened; full of all size stones. One apparently in the common duct. It required a large incision in the thick and friable walls to get out the large stone, which measured 1½ inches long. Drained as in other cases. Operation prolonged and patient in poor condition and rather shocked. Color very poor. At end of twenty-four hours, temperature 102°, pulse poor, and not much drainage. January 7, slightly better but some evidence of congestion over

base of right lung—later in day had an attack of heart failure but rallied. Lung condition progressed. Wound doing very well. Bowels moved freely and no distention. Lung and heart condition grew worse and she died at the end of two weeks from the heart and lung condition. She had been septic and with a myocarditis for several months and was in very bad condition at time of operation.

Dr. Girvin remarked as to diagnosis in these cases: In the first case the condition was plain. The local tenderness was unusually marked. From the literature it seems that the order of frequency of the bacterial cause of cholecystitis is as follows: (1) colon bacillus; (2) staphylococcus; (3) streptococcus; (4) typhoid; (5) pneumococcus, and after that a number of other varieties, but he was inclined to think that typhoid should be higher in the list. Cushing found that 10 in 31 cases had had typhoid. Flexner and Chiari found the typhoid bacillus in the bile in almost all cases dead from typhoid. It is interesting to note that the bacillus has been found in the gall-bladder operated upon seventeen or eighteen years after an attack of typhoid fever (Droba and Hunner). The infection of the gall-bladder may come either through the blood or from the intestines by the ducts (although this method has been questioned), but the source, while it may be anywhere in the body, is usually from the intestines.

In the second case the cause was plainly typhoid, and the picture was typical of a chronic cholecystitis. He was at a loss to suggest the cause in the third case and was not sure that there was not a malignant process associated with the chronic gall-stone disease. None of these cases has had jaundice.

As to the technic of operation, he had followed the incision used by Bevan parallel to the muscle. Pack off very carefully and do not break up old adhesions more than possible. He had drained with a fairly large rubber tube wrapped with gauze and rubber tissue and stitched to the inverted edges of the gall-bladder with plain catgut. Drain into a sterile bottle (bile excoriates skin). He had usually tried to attach the peritoneum to the gall-bladder and closed with silkworm gut interrupted sutures, using small gauze drains at either side of the tube. The tube usually comes out very easily by the ninth or tenth day and the wound will close soon if the gall-bladder edges are inverted.

This method of operation seems best adapted to this class of cases.

Each of these cases had impressed him with how easy it is to overlook a stone and how thorough and careful the search in the ducts should be. The complication of a recurrence of the symptoms from an overlooked stone is not uncommon.

DR. JOHN B. DEEVER said that gall-stones play an important rôle in connection with disease of the upper abdomen. But in more than 700 cases of acute intestinal obstruction he had met with but 2 cases of intestinal obstruction due to stone in the small bowel. It is his experience that more cases of obstruction of the cystic duct are caused by single than by multiple stones.

The typhoid bacillus plays an important part in the causation of cholecystitis. In his cases he had found that the colon bacillus had been more common than the typhoid bacillus; then the pyogenic organisms, and then the pneumococcus is the order of infection. The avenue of infection is most commonly through the portal circulation. He had had two interesting cases in this connection, bowel resection following femoral hernia; one in which the gall-bladder perforated, and both operated on for that condition. In these cases it was evident that the infection reached the gall-bladder through the portal circulation.

With regard to the question of recurrence, he had operated in many instances where it was problematical whether there was stone or not, and in practically all he found the recurrence of pain due to adhesions. He recalled one case in which a recurrence occurred in six weeks, jaundice, violent pain; he opened this patient's belly and all she had was adhesions; she is well at the present time. He had seen a number of instances of that character. He was glad that Dr. Girvin did not excise any of his gall-bladders. He excises a portion but rarely the whole organ. He was convinced, however, that men who take out the greatest number of gall-bladders are the men who see the smallest number of cases.

The question of technic as presented by Dr. Girvin is very good, but he could not endorse stitching the gall-bladder to the parietal peritoneum. He drops all his gall-bladders, putting in a purse-string suture, and inverting the edges. In some he placed a cigarette drain down to the gall-bladder.

Regarding drainage, he uses a cigarette drain in connection with the tube that is in the gall-bladder secured by purse-string

suture. He elevates the foot of the patient's bed so as to confine the fluid to the field of operation. If there is oozing he passes a glass drainage tube down to the subhepatic fossa.

DR. JOHN H. JOYSON said that he saw all of the cases reported by Dr. Girvin. The most interesting was the case in which there was a history of typhoid fever two years previously. She had a very movable right kidney, and her attacks of pain had been attributed by one medical consultant to twisting of the pedicle. On operation the picture of chronic cholecystitis was typical, there being very firm adhesions to the bowel, one so dense and large that a fistulous communication with the intestine through it was looked for but none was present. In connection with the subject of cholecystitis, he could report a case of acute cholecystitis developing during convalescence from operation for appendiceal abscess, a rare complication, examples of which have been reported by H. R. Wharton and others. The patient was a woman, 55 years of age, with an abscess of appendiceal origin which had been drained and the appendix removed three weeks before. The onset of inflammation in the gall-bladder was acute, with pain, fever, and gastric disturbances, followed by development of a palpable swelling. The gall-bladder was drained a week later, four weeks after the operation for appendicitis, and contained much pus but no stones, and a pure culture of *Bacillus coli* was obtained. The patient recovered.

DR. JOHN B. SHOBER agreed with Dr. Girvin that the typhoid bacillus is responsible for a larger percentage of cases of calculous cholecystitis than is generally admitted.

If the nuclei of all the stones removed from any one case are carefully examined, pure cultures will be found in one or more stones and may be absent in all the others. Hence the importance of examining all the stones before a negative report can be made. He was convinced that many cases are overlooked when this rule is not observed. Such cultures are found many years after the occurrence of typhoid fever.

In operating upon these cases, the most important consideration is to secure free drainage not only of the gall-bladder but of the ducts. When this is properly accomplished by means of large calibre tubes, as a rule stones which were not removed or which were overlooked at the time of operation will pass later.

Experience had taught him to avoid cholecystectomy except in rare cases.

CYSTIC DISEASE OF THE BREAST.

BY WILLIAM J. TAYLOR, M.D.,
OF PHILADELPHIA.

DURING the past few years I have had under my care 26 cases of disease of the female breast in which some form of cystic degeneration had occurred, and one case of cystic disease in a male breast. During the same period I have had 28 cases of primary carcinoma of the breast.

I have not included in this list certain other cases of disease of the breast, such as fibroma, adenofibroma, and sarcoma, nor some cases which I have seen in the practice of other surgeons and of whom I have no definite records.

Of these 26 cases of cystic disease, 13, or just 50 per cent., had undergone some form of carcinomatous degeneration at the time of operation. It will therefore be seen that of the whole number there were nearly as many cases of cystic disease as of primary carcinoma in the proportion of 26 to 28, and that of these 26 cases one-half showed unmistakable evidences of carcinomatous degeneration. Several of these had had cystic disease for many years, in one instance for 17 years, and finally at operation cancerous changes were found.

This patient, a trained nurse, was under my personal observation for six years, but would not listen to the question of operation. At times the breast would show distinct evidence of enlargement, and cysts could be easily palpated, while a short time afterwards all evidence of disease would disappear and the breast feel perfectly normal. This was so unusual that for two years, from 1902 to 1904, I made frequent diagrams for record which show that a tumor could be felt in one portion of the breast at one visit and entirely disappear at the next, while later it would reappear in a totally new position. This patient first noticed the breast swollen or lumpy in 1886, with

various degrees of pain and discomfort for two years, when all signs of trouble ceased, and it was not until 1899, or eleven years afterwards, that she again had trouble with it. Again it became normal and remained so for three years, or until 1902. During 1902 and 1903, as I have just stated, she was under my personal observation, and it was then that the diagrams were made. Finally, in 1904, a distinct mass in the upper outer quadrant became pronounced, fairly dense but elastic, and the patient consented to operation.

Microscopic examination showed a cystic breast, and the wall of the largest cyst was carcinomatous. The report was cystadenofibroma with beginning hard adenocarcinoma.

Very fortunately she has had no recurrence and is well to-day, six years since the breast was removed.

Of the 13 cases in which carcinomatous degeneration had occurred, six had cystic disease of both breasts, and a double operation was performed. In five of these one breast was found to be carcinomatous and the other simple cystic disease, while in one case both breasts were carcinomatous. In two of these cases, an aunt and a niece, both breasts were cystic, one of each being carcinomatous, and there had been ten members of their immediate family afflicted with carcinoma in some of its various forms.

My object in presenting this short paper is to emphasize the fact that in my personal experience of 26 cases of cystic disease of the breast, 13 or just 50 per cent., were carcinomatous at the time of operation. I wish to put on record in the strongest possible language that can be used, my belief that all forms of this disease are dangerous, and that certainly one-half of such breasts will sooner or later undergo degenerative changes which will threaten the life of the patient. I know that many writers speak as though cystic disease was a trivial affection and one which does not demand prompt surgical intervention, but this does not agree with my own experience. When a cystic breast which has remained quiescent for a period takes on renewed activity, it is almost certain to be carcinomatous.

Treatment.—At one time I was quite favorable to Dr. Warren's method of operating, by which the gland is turned up on the chest and a wedge-shaped piece taken out which should include the cysts. Certainly, in a few well-selected cases, where the cysts are few and the period of the disease early, this is sufficient. It permits of a thorough examination of the breast, and does not produce the mutilation which a total amputation of the breast entails. Many young women will consent to this who would absolutely refuse the more radical procedure. With increasing experience, however, and after careful study of the history of my cases, I am more and more disinclined to accept this method as in any way adequate to insure the safety of the woman who is so unfortunate as to possess a cystic breast. I now make it a rule never to perform this without having the permission of the patient to do a more radical and thorough operation if I find the disease more extensive than I had originally believed it to be.

In operating, the whole gland should be removed with a wide area of skin, all glandular and fatty tissue removed from the axilla, and the fascia of the pectoral muscle taken away. The muscle itself I do not as a rule remove unless the tissues of the breast appear macroscopically uncertain.

I am so confident of the value of the X-rays in destroying carcinomatous cells and in at least retarding a recurrence of the disease, that I believe they should always be used as a prophylactic measure. Administration by a competent man twice or three times a week until ten or twelve treatments have been given, this to be repeated in three months, and again in nine months, adds materially to the safety of the patient.

When malignant changes have occurred, I believe the use of the X-rays is imperative, and their use should never be omitted. In two of the cases in my series local recurrences took place several times, the primary operation having been performed by other surgeons, probably being insufficient in extent, and finally Beatson's operation, of ovariectomy, was done. One of these patients lived for 13 years. The other, upon whom I operated in September, 1901, is alive and per-

fectly well to-day. In this latter case the X-rays have been employed twice a year, while in the former case they were not.

I have purposely not gone into the pathological histories of these cases, but confined myself to the clinical aspect of the disease, because Dr. John Speese, in the paper which he read at the meeting of this Academy in November, 1909, has covered the ground admirably and fully.

DR. JOHN H. GIBBON said that he would practice complete removal of the breast only under the following circumstances: first, where cystic disease has existed for a long time; second, where there are multiple cysts; and third, where there is recurrence after operation. A single large cyst of short duration demands the Warren operation. It is only after these cysts have existed for a long time that the malignant change takes place. Thirteen out of twenty-six is an enormous percentage, and he would like to know, if possible, how long the cases which were not malignant had existed before operation, and how long the condition had existed in those which were found to be malignant, as this might help to prove the assertion regarding the duration. He had had only one case of malignant cyst, although many of cystic disease in the last few years. This one in which a malignant change took place was a case of multiple cysts of both breasts with complete removal of both breasts and no recurrence after three or four years. McGraw and Abbe recommended the evacuation of these cysts with an aspirating needle and he has done this in three cases without any recurrence. He would not, however, recommend this method of treatment.

DR. JOHN B. DEEVER thought every woman who had a tumor in the breast was a case for immediate operation. At the German Hospital, where from 75 to 100 cases a year are operated upon, he had often been surprised in cases which he considered simple cysts to have the pathologist's report come back stating that malignant change had taken place. Consequently in more recent years they had made it a rule to have every case examined immediately at the time of operation. In a certain percentage of cases the report comes back in five or six minutes of a malignant change, and then he removes the breast.

DR. JOHN SPEESE said that the very high per cent. of malignancy occurring in Dr. Taylor's cases was rather surprising in view of the fact that other writers have found that only 15 to 20 per cent. of the cases of chronic cystic mastitis become carcinomatous. He should be inclined, therefore, to think that Dr. Taylor's cases were seen at a more advanced stage of the disease or that he has included other varieties of disease in his collection. In reviewing the series of cases recently reported by Dr. Speese before the Academy, particular attention was paid to the possibility of a recurrence or malignant transformation in the cases in which plastic resection of the breast had been performed. In no instance had this complication arisen, so that he felt that the operation was safe in properly selected cases, and was especially desirable from the cosmetic stand-point, as the nipple and skin are preserved.

DR. G. G. ROSS said that he had on four occasions started out to remove a cyst by the so-called Warren operation and ended by taking out subcutaneously the whole gland, leaving just the fat, skin, and nipple. He found this very easy and perfectly practicable, and it left a good cosmetic result.

DR. WILLIAM L. RODMAN said that he had always held to the opinion that cystic disease of the breast, if not malignant in a large percentage of cases, was at least potentially malignant, and no one could say what is to be the end result in any case of cystic disease of the breast. No one even at the time of operation can tell macroscopically whether the cyst has undergone carcinomatous change. The former teaching, that if the contents are clear the chances are altogether in favor of benignancy, is far from accurate and should not be followed. Halsted has made this very clear; the thin-walled cysts with perfectly clear fluid are oftentimes the most malignant forms of cystic disease. The only safe way to treat such cases is to have an examination made at the time of operation. He had used the frozen section method for seventeen years and in all that time had known but two mistakes to be made, and one of them by a person of little experience with frozen sections, and he always employed and depended upon frozen sections in every doubtful case. He was in accord with Dr. Gibbon's attitude as to the probable malignancy in cases where there are multiple cysts. On this account the operation of Warren is not always to be advised; this is a

far more satisfactory operation where the cysts are single, but even where they are multiple and seem to be limited to a circumscribed portion of breast, one can afford to take the chance of the mistake being made by the frozen section and wait until a secondary report can be made. Halsted has, however, made this fact clear, that if one overlooks a malignant cyst at the time of the first operation and waits for a report in two or three weeks, the probabilities are that the whole wound has become inoculated; therefore such cysts oftentimes are the most malignant tumors to be found in the breast. He was very partial to Warren's operation; like all good things, however, it has limitations, and one should practise it only where there is a competent pathologist at hand to make a report.

As to the value of the X-rays following operations, he had changed his view entirely in recent years. Formerly he thought it perhaps best to supplement all operations by their use, but he never did so at the present time unless he thought the case a borderline one and that diseased tissue may have been left. He could see no reason why the X-rays should be used unless diseased tissue has been left, and in a complete operation this should not happen. Personally, he had not seen any abiding result from the use of X-rays in the case of carcinoma excepting in the superficial squamous epitheliomata which occur about the face and other parts of the skin. He had seen most excellent results follow the X-rays in sarcoma, not only of the soft tissue but in bones. In carcinomata the improvement has invariably been only temporary.

While he had recognized for years that the percentage of cases of cystic disease of the breast either primarily malignant or undergoing malignant change was a large one, he had not found it as high as reported by Dr. Taylor. This should make us most cautious in dealing with cysts in the breast.

DR. GEORGE P. MULLER emphasized the fact that the diffuse hyperplasia of the breast, commonly called chronic cystic mastitis, is a different disease from the malignant or cancer cysts. The previous speakers seemed to make no distinction between them, and if such distinction is not made he agreed with them that radical operation should be done in all cases of cystic disease of the breast. If one was familiar with the surgical pathology of the breast, and especially had had some years of experience in

the handling of specimens of this disease, checking up gross observations with microscopic examinations made from numerous places, one is able at the time of operation, in an occasional case, to determine whether or not the growth may be confidently considered to be benign. He, therefore, believed that radical operation should be the rule, but that occasionally it was possible to safely perform some such conservative operation as the plastic procedure described by Warren.

STATED MEETING, HELD APRIL 4, 1910

The President, DR. ROBERT G. LECONTE, in the Chair.

THE SURGICAL ASPECT OF EPULIS AND SARCOMA OF THE JAW.

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THERE are many conditions of the jaw the pathology of which differs to such an extent that surgical measures must depend necessarily upon the characteristics of the tumors or diseases in question. The relationship which exists between the class of growths termed in a broad sense "epulis" and other more malignant tumors is an important one. In this paper, attention will be directed only to the connective-tissue tumors of the jaw, and those derived from epithelial structures or the conditions due to faulty development of the teeth will not be considered.

The term epulis signifies a tumor springing from the gums, and although the word has been condemned justly because of the confusion its use has entailed, it has become nevertheless so thoroughly a part of the nomenclature of jaw tumors that it cannot be excluded. Probably the greatest difficulty has been experienced in keeping clear the relationship of the highly malignant sarcomata which, springing from the deep tissues of the jaw, pursue a more unfavorable course than the relatively benign sarcomatous epulides. It becomes necessary, therefore, to properly understand such distinctions in order to describe the varieties of epulides and the sarcomata.

Epulis was used originally to describe any tumor which had its origin in the tissues of the alveolar process of the jaws,

the term being used independently of the pathologic type of tumor. Thus carcinoma, sarcoma, and various benign tumors such as myxoma, chondroma, fibroma, etc., were included. The tendency in more recent times has been to describe as an epulis only the sarcomatous and fibromatous tumors originating on the alveolar margin, and to designate the other tumors in this region by their true pathologic name. Because of their less malignant tendency, the sarcomatous forms of epulis are thus properly excluded from other more dangerous forms of sarcoma, but the term "epulis sarcoma" or "epulis fibroma" should be employed rather than simply to use the vague term "epulis." It is particularly desirable to separate from the epulides the carcinomatous type which is occasionally encountered, because it presents altogether a different clinical course from the sarcomatous epulis.

The histologic examination of collected cases of epulis shows a varied picture. Kühner, in his series of 31 cases, found 20 giant-cell sarcomata, 2 spindle-cell sarcomata, 4 fibrosarcomata, 2 fibromata, 1 osteoma, and 1 granuloma. The proportion of giant-cell sarcoma, about two-thirds of all the cases, corresponds to the observations of most writers. Hesse in a recent contribution, however, has disputed these facts, for he found that of 113 cases of epulis, 30 were sarcomatous, and by far the most common form encountered was fibrous in nature. This difference is explained by the fact that the majority of these cases were seen in a dental clinic, where the small and painless tumors are most commonly encountered, whereas the more rapidly growing and consequently more malignant forms are usually referred to the surgical clinics.

Histologically, giant-cells are found in enormous numbers in the majority of cases, the chief constituent of the tumor being composed of spindle- or round-cells. The tumors contain considerable blood pigment and extravasated blood, and at times are quite vascular, thus explaining their brownish-red color. Spicules of bone are common constituents of the growth, a fact which indicates that the bone-forming layer

of the periosteum is involved in the growth of the tumor. An epulis occasionally arises from the submucous connective tissues, or in the peripheral layers of the alveolar process, and by growing externally appears beneath the mucosa.

The sarcomatous epulis is a pedunculated tumor, dark red in color, more or less movable, and may cause distortion in the outline of the teeth as it enlarges. The mucosa covering the tumor is intact in the early stages, but sooner or later shows points of erosion due to local traumatism, from which slight hemorrhage may occur. The tumors are usually soft in consistency, but may be firm and hard when of the fibrous or the fibrosarcomatous type.

The statistical studies of Kühner, Gunzert, and others, show a marked predisposition of the female sex, in whom two-thirds of the cases occur. While the disease may be seen at any time of life, it is most commonly encountered in the second, third, and fourth decades, although it is not uncommon in younger and older individuals.

Among the factors chiefly concerned in the etiology of epulis, caries of the teeth may be mentioned as the most prominent. The irritation of ragged, irregular, diseased teeth plays an important rôle in the formation of these growths, and such a history will be obtained from the majority of patients. In the instances in which extraction of a diseased tooth has been followed by the formation of a tumor, it is likely that the traumatism was sufficient to cause active growth of cells left behind after the removal of the tooth. This is especially likely when we bear in mind the tendency of the tissues of the mouth, the mucosa and the periosteum of the alveolar process to react to any sort of irritation. It should be mentioned, however, that epulides occur in the presence of sound teeth and under proper oral hygiene, neglect of which seems to act as a predisposition to the formation of the tumors. The influence of pregnancy in the development of an epulis has been repeatedly mentioned; the association, while difficult to explain, seems to be more than a mere coincidence. Finally the effect of artificial teeth, the irritation of pipe smoking, and other

forms of long-continued traumatism may be mentioned as possibly having some etiological importance.

Clinically the tumors rarely cause serious symptoms. The jaw may be infiltrated in the late stages of the disease and absorption of the cortex arise; it may extend to the antrum or nasal cavities, displace the tongue, or cause protrusion of the lips. In the very large tumors, difficulty in chewing, swallowing, and speaking may be caused. Pain, which at times is complained of, is due to the diseased condition of the teeth. Repeated traumatism may cause hemorrhage from the more vascular growths, which in time may cause a moderate degree of anæmia. The ulcerative condition of the gingival mucosa may play a rôle in causing more rapid enlargement of the epulis.

The benignancy of this class of neoplasm is well demonstrated by the fact that metastasis to the regional lymph-nodes occurs practically in advanced cases only. The enlarged nodes seen in the course of an epulis are usually of inflammatory origin, and are caused by infection absorbed from carious teeth. In many instances the nodes disappear after extirpation of the tumor, and in those cases in which the enlarged lymphatics were removed with the tumor, microscopic examination has failed to reveal malignancy in the nodes.

The tumor generally exists for a considerable period before operative intervention is carried out; in most instances a year or more may elapse until rapid enlargement of the epulis causes the patient to seek surgical aid. Perthes is inclined to place little weight in the view that the giant-cell tumors are less rapid in their growth, because he has observed cases of the same histologic character, in which marked difference in rapidity of the enlargement has been present.

It is a well-known fact, that whereas epulis is a tumor benign in nature from the clinical stand-point, it tends to recur when insufficiently removed, and in such cases the recurrent tumor may take on a more rapid growth. Kühner records 11 recurrences in 90 cases of epulis—the operation in this series removed only the visible tumor tissue and not the portion of

the alveolar process from which it sprang. If secondary operations are carried out promptly, the chance of ultimate cure is good, for instances are on record in which repeated operations have finally resulted in a cure.

That the prognosis is good is shown in the very large percentage of cures which ranges from 75 to 97 per cent. An important observation was carried out by Kühner in four of the cases not undergoing operation for the radical removal of the epulis. He found that three died from the effect of the tumor, one of general sarcomatosis; the second, a man fifty-four years of age, of extensive recurrence; and the third, a male aged sixty-six, from blood poisoning originating in the epulis. In the fourth case, a boy aged five, spontaneous healing occurred and persisted for a period of 25 years. From these cases and similar observations, it is apparent that epulis, if neglected, may become highly malignant, and resemble in this particular the sarcomatous growths of the jaw.

Fibroma.—This affection appears as a central growth, or it may arise from the periosteum and appear as an epulis of the fibrous type. The growth has many of the characteristics of the sarcomatous epulis, but appears harder and more compact, owing to the large amount of fibrous tissue in its structure, which accounts for its lighter color. In some instances the cells of the tumor are so abundant that the growth is quite soft, resembling a sarcomatous epulis for which it is mistaken at times. Eve holds the opinion that most of the so-called fibrous epulides are sarcomata, for in his series of cases a pure fibrous epulis did not exist. This, however, does not correspond with other observations; I have studied two cases in which there was no evidence of sarcomatous tissue in growths which were classified as fibrous epulides. Gunzert described myxomatous degeneration of the tissues which is particularly prone to arise in the tumors of long standing. The base of the epulis may contain lime salts or spicules of bone. While the tumors are usually small, they at times reach a large size and are dangerous from a mechanical stand-point. Sudden enlargement is indicative of a malignant degeneration, *i.e.*, sar-

coma. Perthes calls attention to the tendency of the fibrous epulis to appear as multiple growths affecting both jaws.

The central variety of fibroma differs as greatly from the fibrous epulis as does sarcoma from a sarcomatous epulis. The growth, according to Perthes, may occur in either jaw, but is more common in the lower. The tumor takes its origin from the central part of the bone, and as it grows the periosteum and cortex become expanded over it, forming a thin shell, or the rapidly growing tumor may be covered with a layer of tissue containing bone trabeculae derived from the periosteum. The tumor may be firmly attached to the bone covering it or lie free in the cavity. When seen in the upper jaw, the tumor tends to spread toward the antrum, or may arise primarily in that situation.

The growth of a fibrous epulis is essentially a slow one, it may occupy many years in its development, and most commonly occurs in the third and fourth decades of life. The enlargement does not, as a rule, produce pain unless pressure is exerted upon nerves, as, for example, infra-orbital neuralgia may occur in the fibromata of the upper jaw. There is no tendency of the tumors to metastasize, ulcerate, or infiltrate the surrounding tissues, all of which point to its benign nature. Secondary infection and necrosis have followed exploratory incision in a fatal case recorded by Heath.

The diagnosis depends largely upon the gradual growth and painless course of the fibroma. If the tumor is attached to the lower jaw, distending it, and if surrounded by a shell of bone, the differential diagnosis between it and other benign growths will be difficult, and may only be made by aid of a Röntgen examination. The differential diagnosis may also be difficult in slowly growing myxosarcomas in the same location.

The operative measures in these cases demand complete removal of the tumor and the portion of bone to which it is attached. Only in exceptional cases will it be necessary to do total resection, and then only when the size of the growth prevents less radical measures. Following partial resection

of the jaw and the tumor, the results have been satisfactory, since the benign nature of the fibroma excludes the possibility of a recurrence.

Sarcoma.—Sarcoma of the jaw occurs less frequently than carcinoma, the proportion being about two cases to the former to three of the latter. The relative frequency of sarcoma of the jaw is shown by Gurlt's statistics in which 14,630 tumors included 532 growths of the jaw, and of the latter 179 were sarcomata, 96 occurring in the upper jaw and 63 in the lower. From these statistics and other observations, the upper jaw is found to be the more common site of the tumor. As already noted in the sarcomatous epulis, the female sex is more often affected; the same relative proportion is observed in the jaw sarcoma. In Perthes's collected statistics of 126 cases, 55 were men and 71 were women.

Trauma seems to play an important rôle in the etiology of sarcoma. Whether the effect of injury is manifested by the stimulation of tumor cells already present, or whether the trauma is even more intimately concerned in the origin of the growth, is difficult to prove. The cases which I have studied show in several instances that trauma played a part in the development of the tumor. In one instance a very large sarcoma began its initial growth several months after the extraction of two teeth and reached its maximum size in eight years. It is possible in this case that the effect of trauma was manifested by increased rapidity in growth of cells, which were present at the site of the diseased teeth, but which were more or less inactive previous to the traumatism. In another instance, a boy aged twenty-two was injured while boxing, and several of the lower teeth were loosened. After this accident tenderness was present for several months, and then swelling of the jaw arose. This condition lasted for three years, when rapid enlargement took place, so that four years after his accident a definite mass the size of a hickory-nut projected from the middle of the ramus of the lower jaw. This tumor and the adjacent portion of the jaw were removed by Dr. C. H. Frazier, and on microscopic examination was found to be an osteosarcoma of a low degree of malignancy.

Histologically all varieties of sarcoma occur and follow the general rule that the smaller and more abundant the cells, the greater the degree of malignancy, as manifested by rapidity of growth, metastasis, and tendency to recurrence. The giant-cell sarcomata are the least malignant and resemble the tumors of similar structure found in other bones in respect to their slow and relatively benign course. In contrast to the simple forms of sarcoma, those in which cells of the original embryological jaw structure are reproduced present a more varied picture. Thus chondrosarcoma, fibrosarcoma, and osteosarcoma are met with, all of which possess a greater or less degree of malignancy, depending upon the number and size of the sarcomatous elements.

A curious tendency of the last named type lies in the formation of highly malignant secondary growths composed of pure sarcomatous tissue, in which the bone or cartilage may not be reproduced. In general it can be said that sarcoma of the jaw has but a slight tendency to metastasize to the regional lymphatics draining the area and tends still less to spread to the viscera. Enlargement of the cervical nodes may be present, but in many instances it is the result of infection rather than a secondary tumor formation. It is not an uncommon experience to see enlarged nodes disappear after the jaw tumor is excised, although it is a safer and more scientific surgical principle to remove enlarged nodes, as in any radical operation for the cure of a malignant tumor.

The symptoms produced by the peripheral form of sarcoma differ somewhat from the central variety. The latter tends to produce more or less hard, rounded, circumscribed tumors which generally enlarge toward the outer surface, and may be mistaken for dentigerous cysts. Later in the course of the growth, the cortical layers of the compact bone become rarefied, and the crackling sensation common to central sarcoma of bone may be produced. As the tumors enlarge, pressure symptoms develop, thus œdema of the eyelid and mucous membrane of the antrum, dislocation of the eyes or teeth, dilatation of the superficial facial veins, obstruction of the nasal

duct, and difficulty in speaking and swallowing may occur. The periosteal tumors present a somewhat different picture, in that the shape of the growth varies, it takes its origin directly from the periosteal covering of the jaw, a fact easily demonstrable on palpation. In the early stages the mucosa is intact, the growth is painless until it undergoes ulceration or the infiltration of the bone causes pain. Pain is also seen in the neoplasms which press upon nerves. Neuralgic conditions of the teeth may arise and direct attention to the cause, a beginning sarcoma.

The operative indications of jaw sarcomata depend on the histologic type of tumor and the extent of the growth. Perthes's statistics based upon the results obtained in several clinics lead us to conclude that, after a period of three years, a third of the cases of total resection of the jaw for sarcoma will remain well. One-half of the patients develop recurrence, a fact which demands still more radical measures in treating these cases. It must be stated, however, that partial resection of the jaw has met with considerable success, but too great emphasis cannot be laid upon the class of cases for which this operation is indicated. The small, well-circumscribed, giant-cell sarcomata situated on the alveolar margin of the upper jaw, irrespective of epulis, and sarcoma of the hard palate may be partially resected. Similar growths on the alveolar process of the lower jaw may be treated in the same way, but all other forms of sarcoma should be subjected to total resection. The percentage of cures in these cases will increase if we operate at an earlier period, before the growth has involved a large area of the bone. The slight tendency toward regional or general metastasis should prove of great value in favoring early operation, and markedly assist in cure because of the lessened possibility of recurrence.

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DR. W. M. L. COPLIN (by invitation) said with reference to melanotic tumors of the jaw that he had seen specimens from a number of these cases and did not know of a single one in which recurrence did not take place. Dr. Speese spoke of the prognosis based on histological examination. This may be possible if the tumor contains many giant cells, but when dealing with neoplasms composed of round or spindle cells the method becomes of doubtful value; it is probable that in these cases the outcome depends largely upon the resistance of the patient. Usually the paramandibular tissues are not involved early, a fact depending upon the architecture of the jaw, the periosteal and intra-osteal tissues acting as a filter that resists extension of the growth.

Another point worthy of attention is the relative immunity of the submaxillary and sublingual glands. Of the specimens which come to the laboratory for examination, he had seen one in which either a submaxillary or a sublingual gland was extensively invaded. He had seen the growth almost surround a salivary gland but for some reason or other it is rare to see it penetrating the lobes or even the interlobular tissues. In all neoplasms of the mouth the salivary glands are attacked late, if at all. He had never seen a telangiectatic sarcoma of the jaw in which there has been extensive ulceration, a fact for which a fully satisfactory explanation is wanting. The jaw enlargement is accomplished by internal osseous absorption and continual subperiosteal apposition. He had one specimen removed by Professor Hearn in which the involved area of the jaw was larger than a fist, and still there was no sign of extension through the outer bony layer and no involvement of the soft parts; this tumor presented egg-shell crackling in a very marked degree.

DR. A. P. C. ASHHURST inquired whether Dr. Speese had succeeded in following any patients treated by radical operation. It has been claimed by recent writers that it is useless to do a radical operation as the disease, if highly malignant, recurs in a few months and the patient dies; whereas an operation consisting in an evacuation and scraping of the tumor is sufficient in cases which are not so malignant.

DR. JOHN SPEESE rejoined that the diagnosis in most of the cases operated upon at the University Hospital had been made from the clinical appearance of the tumors, although in some

instances frozen sections had been made when the growths had been soft and not infiltrated with lime salts or bone. In the central sarcomata, in three or four cases, the bone was trephined and sections taken for microscopic examination, the operative procedures being based upon the character of the growth, the giant cell tumors being treated by less radical measures than other types of sarcomata.

His experience agreed with that of Dr. Coplin for the salivary glands had been involved rarely in malignant disease of the mouth and jaw. Their records show that many of the periosteal and central sarcomata, both round and spindle cell in type, have been cured. The number of cases traced through the Surgical Laboratory does not permit him to state at present, however, the percentage of cures in the cases operated upon.

ENTEROPTOSIS.

DR. GEORGE P. MÜLLER reported a number of cases of enteroptosis, and remarked that the abdominal organs are held in position by the negative pressure of the thoracic cavity, the mutual support of the different organs, the peritoneal, ligamentous and vascular attachments, etc. If these are interfered with, ptosis will result, and such interference may occur from congenital or acquired causes.

The congenital type is usually seen in a thin, pale, young woman, of slight build, with a long sunken thorax, flabby abdominal walls, a juvenile expression and a bodily form exactly like that seen in the tuberculous. The tissues are inherently weak and fragile and the actual displacements occur from secondary causes such as exhausting diseases, marked loss of weight, overstrain, lack of proper nourishment, constricting clothing, pregnancy, uterine affections, prolonged cough from bronchial affections, etc. The earlier manifestations are seen in the attacks of dysmenorrhœa and chlorosis that young girls experience and later the symptoms may be erroneously interpreted in such vague terms as neurasthenia, nervous exhaustion, chronic constipation and change of life. There is no essential difference between the symptoms due to a movable kidney, a retroverted uterus or a displaced colon except those dependent upon the drag on different anatomical supports, the general phenomena being the same.

The symptoms are referred to the digestive apparatus, the generative organs, the nervous system, or to the body generally; gastric hyperacidity, flatulence, constipation, vague abdominal pains, backache, pelvic troubles, leucorrhœa, headache, menstrual and vesical troubles, melancholia, nervousness, etc., are the most prominent symptoms and the patient complains of a total lack of energy, physical and mental. There is a lightness of weight and a general relaxation and flabbiness of the tissues.

Physically, the oblique slant of the ribs, the acute epigastric angle and the very long abdomen and small waist are characteristic. The tenth rib may be freely movable or floating (Stiller's sign). One or both kidneys are often palpable, the liver is displaced and its edge palpable, the stomach displaced and may be dilated, the colon and sigmoid are usually displaced and often redundant, the uterus may be retroverted or flexed.

A movable cæcum may produce symptoms indistinguishable in many cases from true appendicitis and Klose believes that in many of the cases of recurrence of trouble after operation without supposed chronic appendicitis a movable cæcum is at fault.

The *acquired type* is due (1) to rupture of the pelvic diaphragm from childbirth which, if extensive and not properly repaired, may after a time weaken the abdominal supports and not only the uterus but the intestines may become displaced; (2) to constipation, which by overloading the colon or sigmoid may directly induce ptosis; (3) by tight lacing which tends to force the intestines downward and loosen the liver; (4) to adhesions from inflammatory disease or from operations causing a drag upon the omentum, and by direct traction the colon is pulled downwards, and drawing upon the stomach it in turn is displaced.

No case of enteroptosis should be operated on until medical means have been exhausted without relief. The patient should be treated, if the displacement is of the congenital type, in exactly the same way as are tuberculous patients, and the outdoor life should be especially emphasized. The diet should be carefully regulated and food causing flatulence or constipation avoided. Certain drugs, especially tonics and laxatives, may be needed at times, but are of minor importance. The abdomen must be supported by an efficient bandage, and it is well to advise elevation of the pelvis for an hour or more before retiring. If the patient is young and the thorax movable she should be taught a system

of breathing exercises in order to increase the capacity of the lungs and the size of the upper abdomen.

The question of when to operate is difficult to answer in the congenital type. In general, it may be stated, that if some one organ is markedly ptosed and the symptoms are especially referable to this organ, an operation should be advised, but if the kidneys, stomach, colon, uterus, etc., are all displaced and the symptoms general, operation only complicates the condition, and as Clark has said, "A pathologic condition may be left behind which imposes a still greater burden upon the defective dynamo and makes a more hopeless neurasthenic of the patient than ever."

The acquired cases, on the other hand, offer splendid opportunities for conservative surgery, the type of operation depending upon the condition causing the ptoses. Repair of the perineum, suspension of the uterus, shortening of the uterosacral ligament, suspension of the colon, of the stomach, and of the liver, are the operations most commonly practised. In addition to these the separated recti should be brought together by some operation such as Webster's. A large part of the fat may be excised from a pendulous abdomen, as recently practised by Howard Kelly, or the oblique muscles may be strengthened by some such operation as the one recently published by Coffey. In recent years a number of operators have proposed excision of part or all of the colon. Dr. Müller commends the excision of most of the transverse colon or of the sigmoid in selected cases as it undoubtedly will be frequently performed in the future, but believes that Lane's proposal to excise the entire colon and anastomose the ileum to the sigmoid is unnecessarily severe and certain of a high mortality. The operation of iliosigmoidostomy with exclusion of the colon is not rational and will probably fall by the wayside, the experimental work being decidedly against its value.

Finally, he urged the necessity for caution in these cases, as too much operating can easily be done and the results if bad are almost irremediable. The surgeon should endeavor to grasp the salient points in the cases, repair the major lesion and trust to his after-treatment to finish the cure of his patient.

DR. WILLIAM L. RODMAN said with regard to gastroptosis, he personally had believed it unwise to operate on the majority of these cases, yet there are exceptional ones demanding operation. He had recently encountered such a case in a patient referred to

him by Drs. Anders and Pfahler. The patient was a small woman and the degree of dilatation and displacement of the stomach was so marked that the medical men considered that the case required operation. She vomited constantly, being unable to keep anything on her stomach. Dr. Pfahler had skiagrams made several years ago and some made more recently, indicating that the stomach was twice or thrice the size it should be. The stomach was so large that it was in the pelvis; this naturally produced a kinking at the pylorus, and interfered with the organ emptying itself. It seemed that nothing short of a pylorotomy would do any good. Between one-third and one-half of the stomach was removed and the remaining portion sutured to the parietal peritoneum or anterior abdominal wall. There has been a skiagram taken since the operation, a day or two before she left the hospital, which shows now the remaining part of the stomach in good position. She has not vomited since the operation; she is putting on flesh. This is one case in which operative interference was undoubtedly warranted.

We probably have been remiss in the past in not operating on more of these cases. Undoubtedly, however, the old rule that where there is general dropping of all the viscera operation is not indicated, holds good; but, where the ptosis is limited, operation is both desirable and advisable.

CHROMO-URETEROSCOPY IN FUNCTIONAL KIDNEY DIAGNOSIS.

DR. B. A. THOMAS read a paper with the above title.

Dr. Thomas further remarked that in chromo-ureteroscopy it is desirable to insure a perfectly colorless fluid content of the bladder, and he believes this, in many instances, can be obtained only by prolonged irrigation. In bad cases of hæmaturia or pyuria it becomes positively essential. This can best be obtained and maintained by an evacuation cystoscope which permits of frequent and speedy evacuation and refilling of the bladder, because very frequently the bladder content may become clouded and it will be impossible to judge as to the character of the elimination of the dye. An absolutely brilliant illumination is necessary so that the landmarks in the bladder as well as a weak color reaction will be distinctly visible. If these two conditions are not secured, in certain cases where there has been

chronic retention of urine or chronic parenchymatous nephritis, in which diseases the elimination of the indigo as a light blue will simply ooze out of the ureteral orifices instead of being ejected as a spurt, judgment of the test will be vitiated and conducive to erroneous conclusions.

It would be of value to one undertaking the work for the first time to have the history and know the physical examination of his case. So far as the results of the cases here reported are concerned, Dr. Thomas refers the questioner to a careful review of the charts, noting the time of elimination and color reaction in detail, for it was with respect to these observations alone, to prove their value or worthlessness, that the charts were compiled.

STATED MEETING, HELD APRIL 25, 1910

The President, DR. RICHARD H. HARTE, in the Chair.

THE RELATION OF THE DUCTLESS GLANDS TO SURGERY.

BY J. E. SWEET, M.D.,
OF PHILADELPHIA,

Assistant Professor of Experimental Surgery in the University of Pennsylvania.

THE relation of any given subject to surgery is primarily and always—in the broad sense—precisely the same as the relation of that subject to the fundamental field of the philosophy of medicine. There are certain things, however, which bear a more particular relationship to some one or other of the various special branches; among those fields in which surgery should be especially interested is the problem of the function and the pathology of the ductless glands.

The problem bears a threefold relation to surgery. In the first place, the surgeon is often specifically concerned with the treatment of the pathological conditions occurring in these glands. A mere enumeration of these structures will suggest many such instances, like acromegaly and exophthalmic goitre; this physiologic group comprises the hypophysis and perhaps the pineal in the brain; the thyroid, parathyroid, and carotid gland in the neck; the thymus in the chest; the spleen and the adrenals in the abdomen; the lymphatic system. There are also certain ganglion-like structures in various parts of the body, belonging to the sympathetic nervous system, and grouped together as the chromaffine system. In addition to the true ductless glands, many, if not all, organs with distinct ducts have also an internal secretion which may be even more important than the external secretion; the internal secretion

of the liver is of far greater importance than its external secretion of bile.

In the second place, the surgeon should have a special interest in all these glands of internal secretion, because it often requires a mastery of surgical technic to make possible an approach to the study of their function. An excellent example of this is the recent work of Cushing on the pituitary gland. Or, again, because of a surgeon's familiarity with the pathological picture, he may have acquired a peculiar position of authority in the study of the etiology of these conditions: an example of this is the work of Bircher on the etiology of goitre.¹

The last element in this threefold relation of these structures to surgery is the one to which I would especially call attention, a relation which, it seems possible, may exist in the practice of general surgery. I refer to the relation of that group of structures known as the "chromaffine" system to the blood-vascular apparatus, and specifically to blood-pressure. The term "chromaffine" is derived from the presence of certain cells which possess a peculiar affinity for the salts of chromic acid; in the case of the adrenals, it is considered satisfactorily demonstrated that these cells are the ones which contain the pressor substance characteristic of the gland. The chromaffinity of these cells is therefore taken as the index of the functional state of the gland, although a fair doubt of the correctness of this assumption may be entertained.

It is not within the scope of this paper to enter into a discussion of blood-pressure, because it is such a complicated problem that it cannot be handled at all unless exhaustively. For the purpose of the present argument, we will therefore leave out of consideration all the factors concerned in blood-pressure except three, which three, it so happens, are also the factors which must probably be most important in a given space of time, such as a surgical operation. These factors are: first, the vasomotor centres in the brain and cord; second, the paths along which the power generated in the centres is transmitted, the vasomotor nerves; and, third, the mechanism by

which the power generated in the centres, and transmitted by the nerves, accomplishes work.

For our present purpose we may define blood-pressure as the result of an opposing of a resistance to the force of the heart-beat; variations of pressure are brought about by varying this resistance. It is generally held by physiologists that the chief resistance to the blood flow is offered by the arterioles and not by the capillaries: changes in the calibre of the arterioles will greatly vary the resistance, and therefore the blood-pressure. These changes of calibre are made possible by the coat of smooth muscle-fibres which surrounds the arterioles. These muscle-cells are in a condition of semicontraction known as "tone," and they are kept in this state by factors entirely apart from the nerve-centres of the brain or cord.

If I may be pardoned a homely simile in order to make my point of view perfectly clear,—no matter how perfect the construction of the engine, no matter how correct the system for the transmission of power, the engine will probably saw no wood if there be no saw for it to turn; and if a saw be present the total efficiency will depend as much upon the condition of the saw as upon the perfection of the engine. To transfer these terms,—the vasomotor centres may be efficient, and the nerves may be normal, but the musculature of the arterioles may not be able to respond. No theory of shock can be complete unless all these factors are given their due consideration.

The result of the experimental removal of the adrenals as well as the study of cases of pathological destruction of the glands, in Addison's disease, shows that the internal secretion of the adrenals is directly concerned in maintaining the tone of the vascular system. It is for us immaterial whether the adrenalin act directly upon the muscle-fibre or upon the end-plates of the nerves within these fibres.

Within the past few years there have appeared several articles in which the authors have presented the results of studies of the effect of narcosis upon the adrenals, and of studies of the adrenals in cases of death due to narcosis. It is to this relation of the chromaffine system to general surgical practice

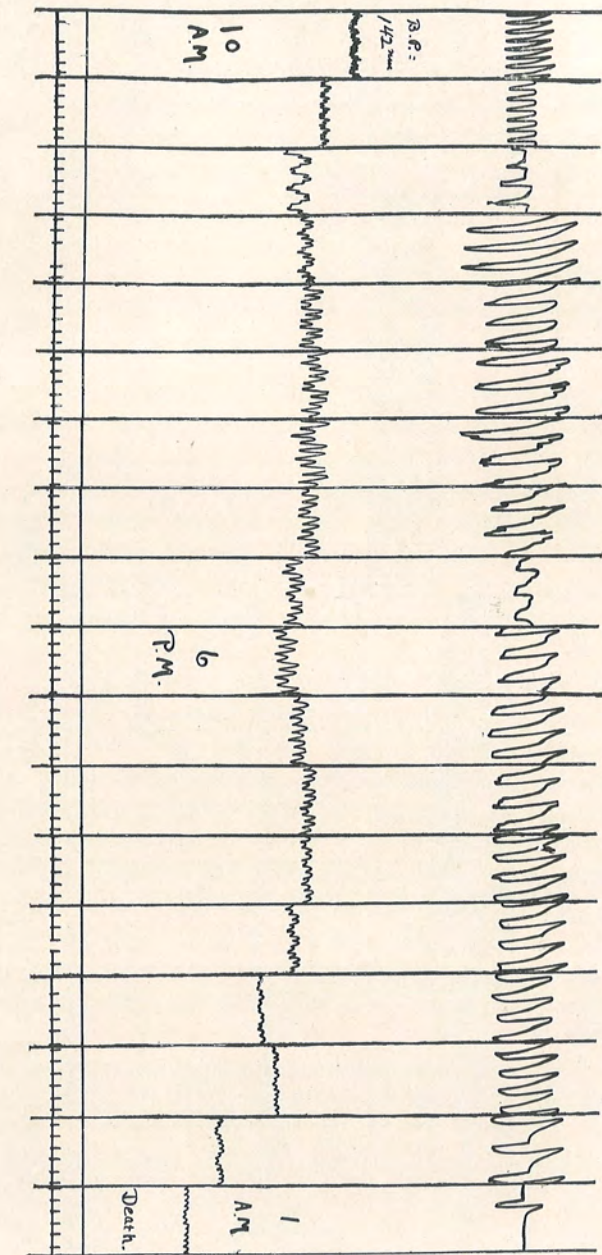
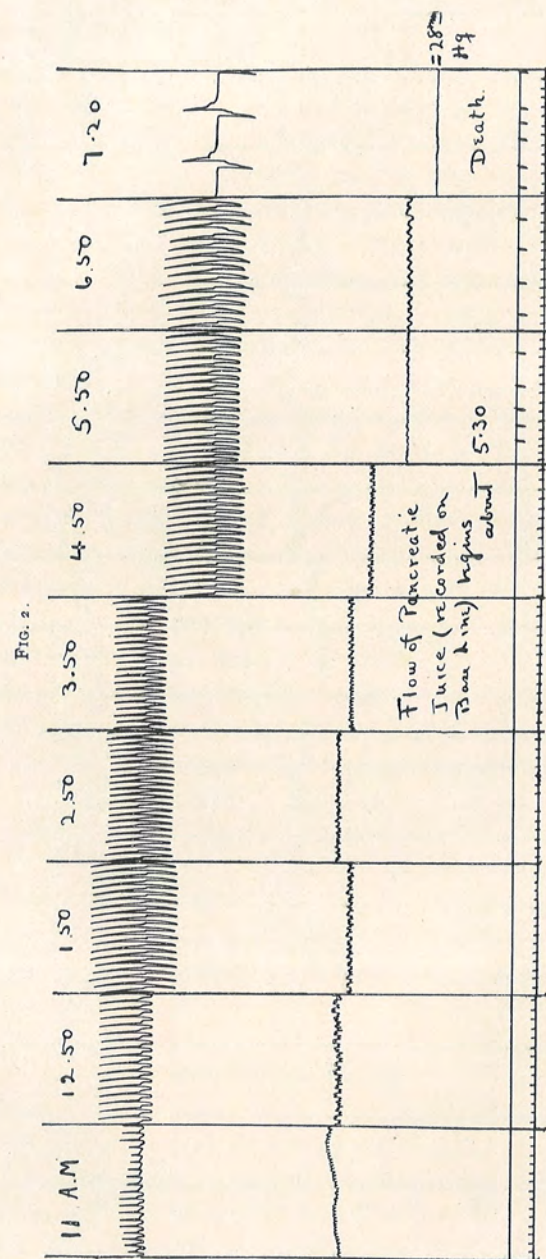


FIG. 1.



that I wish to call your attention. In the course of our study of the interrelation of the internal secretions, Dr. Ralph Pemberton and I have had occasion to keep dogs under ether anaesthesia for long periods, as also to extirpate one or both adrenals in addition to long periods of anaesthesia. We have not been in a position to systematically study all our experiments from the stand-point of the effect of ether narcosis upon the chromaffine system. Our observations have, however, led me to feel that the results obtained by others are, in the main, correct. I have also been able to prepare a few specimens and tracings for demonstration.

Wiesel² found in a number of cases of status lymphaticus an extraordinary hypoplasia of the chromaffine tissue. This finding was confirmed on a large material by Hedinger.³ The fact that the status lymphaticus renders the patient especially susceptible to accidents of narcosis led Schur and Wiesel⁴ to an experimental study of the effects of narcosis upon the chromaffine system. They found that the specific cells of the medulla of the adrenals showed a progressive loss of affinity for chromic acid salts, this decreased staining reaction becoming more marked as the time of narcosis lengthened until, after three to five hours of narcosis, no more chromaffine cells were found; synchronous with this loss of chromaffine substance was the disappearance of the mydriatic action of extracts of such adrenals on the enucleated frog's eye, and the disappearance of the iron chloride reaction. If the animals were allowed to recover from the narcosis, the chrom-reaction reappeared, the time of reappearance varying, until from eight to twelve hours later the cells possessed their normal affinity for the chromic acid salts. The extract of an adrenal after five hours' narcosis showed no physiologic effect in one experiment. The result was the same with either ether, chloroform, or Billroth's mixture.

Parkinson⁵ states that he found no chromic acid reaction in the medulla of the adrenals from two cases of postoperative shock.

Hornowski⁶ found in four cases of postoperative shock a condition similar to that reported by Parkinson. His experimental results are practically the same as those cited from the work of Schur and Wiesel. Hornowski's most interesting conclusions

are the following: "Chloroform increases the need for tonic substance, and at the same time causes an exhaustion of the chromaffine system, which may cause death." "Chloroform does not cause an immediate exhaustion of the tonic substance, but gradually, after several hours." "Chloroform may cause a sudden exhaustion of the chromaffine substance if it be not present in abundance." "The resistance of the organism to surgical shock is expressed in the possibility of satisfying a greater need for tonic substance, and in the ability of the organism to secrete it."

Kostlivy⁷ reports two cases, one of death occurring 72 hours after narcosis, in which the chromaffine substance was found intact; this result he explains in the sense of a regeneration, following Schur and Wiesel. A second case in which death occurred 24 hours after narcosis showed no demonstrable chromaffine substance.

Schwarzwald⁸ concludes from a study of ten cases of death during and after narcosis, in seven of which the chromic acid reaction of the adrenals was found intact, that the question of the integrity of the chromaffine tissue under the influence of narcosis does not possess decisive importance. It must be added, however, that in three of these cases fatty degeneration of the heart was noted, and a fourth was operated upon while in eclamptic coma.

Kahn⁹ endeavors to prove by extensive experiments that the work of Schur and Wiesel is based upon untrustworthy technic, and that therefore their results are incorrect.

A fairly extensive series of tests with the enucleated frog's eye, carried out by Dr. Pemberton and myself in connection with another phase of our work, led us to a conclusion in full agreement with Kahn, that results obtained by this method are not dependable; yet the results seem sufficiently accurate to enable one to draw such a general conclusion as the one that narcosis affects the adrenals. At the same time it is also fair to criticize one part of Kahn's own work. He made extracts of the adrenals after narcosis and found that they always gave a positive physiological reaction, but he used no norm for comparison. It is in such experiments a question of the amount of pressor substance as compared with some normal standard, not of its absolute loss. Dr. Pemberton and I have

often observed in the normal animal that the ether must be pushed beyond mere anæsthesia before an effect upon blood-pressure is obtained, so that five hours' narcosis may not have meant the same thing in the experiments of Schur and Wiesel and those of Kahn.

In reviewing the notes of the work with Dr. Pemberton, I find of our last ten experiments, in which special attention to the condition of the adrenals was directed at autopsy, nine are noted as having the gross appearance you will see in the Kaiserling preparations,—the medulla is darker in color than normal, and around the circumference of the medulla are hemorrhages which extend radially a slight distance into the cortex, giving the organ a striated appearance. In one experiment the macroscopic appearance is noted as normal. I have made a few extracts of such adrenals, and in one instance it was evidently much less active than an extract of the adrenal from a normal dog; in another no marked difference could be seen.

Nevertheless, in spite of the fact that part of the technic used by Schur and Wiesel has proved unsatisfactory in our hands, and that the reaction to chromic acid salts may be uncertain or at best may not necessarily show the condition of functional efficiency, I still feel that the facts brought out by Schur and Wiesel and Hornowski are correct. This feeling is based upon the results we have obtained by the use of entirely dissimilar methods.

The most satisfactory proof I have seen that narcosis affects the adrenals is, first, in a comparison of the curve of the blood-pressure of a dog under ether with that of a dog from which the adrenals have been removed. In both there is the same gradual, progressive fall of pressure, occurring sooner in the dog from which the organs were removed; the time of fall in the normal dog can be hastened by increasing the rate at which the ether is administered. And, second, in our study of the interrelation of the glands of internal secretion, Dr. Pemberton and I have found that the pancreas begins to secrete after the removal of the adrenals, and may show an astonishing

secretory activity over a long period until the animal's death. This fact, together with the fact that adrenalin inhibits the flow of pancreatic juice which follows the intravenous injection of secretin, leads us to conclude that the adrenals exercise some sort of control over the pancreas. In the etherized normal dog this flow has never appeared; but there may, and often does, occur in the last minutes of life after prolonged etherization a flow of pancreatic juice, which we are inclined to feel indicates that the adrenals have been so affected by the narcosis that they have lost their control over the pancreas,—in other words, that the adrenals are exhausted.

In all our experiments we have a continuous record from the beginning of the experiment until the end, of the respiration, the blood-pressure, and the time in seconds, as well as the flow from the pancreas whenever it occurred. The only characteristic feature, aside from the flow of pancreatic juice in those cases where it occurs, is the gradual but progressive fall of blood-pressure; in some instances where a valvular heart lesion was found at autopsy, the addition of ether may be seen to cause sudden falls of pressure, which may sometimes be immediately fatal.

It is in regard to this point that the experience and more careful observation of the surgeon is needed to a proper elucidation of the problem. It should be perfectly evident that a change in the adrenals would not be expected in every case of sudden death during or after narcosis. It is astonishing to note that Schwarzwald included three cases of fatty heart, and one of eclamptic coma. I am of the opinion that the term "shock" should be more strictly used, and should only apply to those cases where neither the case history nor an autopsy reveals any other cause of death save the progressive fall of blood-pressure.

At the same time the solution of our problem must await a satisfactory laboratory method for determining the functional efficiency of the adrenals. It does not appear to me that a staining reaction is necessarily indicative of functional efficiency; as we have seen, the mydriatic reaction, as tested

upon the pupil of the enucleated frog's eye, is unreliable for quantitative tests; the iron chloride and the sublimate reactions are of doubtful value; and even the physiologic test of extracts of the organs does not prove the point; for the amount of adrenalin is not the only variable,—the susceptibility of the musculature to the action of the adrenalin may be variable, so that what would be a functional adrenalin content of the gland in one animal would not suffice to maintain the vascular tone of another.

Two points stand out from the somewhat indefinite condition of the problem of the relation of narcosis to the chromaffine system; first, the necessity for an accurate clinical classification of cases of death due to narcosis; second, the hope that a rational treatment of cases of shock—the prophylactic treatment—may soon be materialized.

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- ⁷ Casopis lekuru, 1909, Nr. 2, cited by Schwarzwald, Verhandlungen d. deutschen path. Gesellschaft, 1909, xiii, 268.
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- ⁹ Pflüger's Archiv, 1909, cxxviii, 519.

DR. W. M. L. COPLIN (by invitation) said that recently Caccio has published in Italian a paper on cellular lipoids in which he deals with the influence of the chromic acid salts on these bodies and suggests very strongly that there is some relation between chromaffine substance and the lipoids contained within certain tissue cells. Admitting the correctness of views which Dr. Sweet has given, concerning the influence of anæsthetics, then there is a chemical explanation for the observation brought forward in his paper. If these substances are soluble in the agents used in anæsthesia, then, of course, one at once appreciates why they become so readily diffused, and why under such circumstances exhaustion of the lipoid-producing cells would be more

rapidly established under the influence of agents which are in a way solvents of such bodies. One of the most interesting thoughts with regard to these observations is the suggestion that the solubility of some of these constituents of cells appears to be much greater during life than postmortem; the abstraction of these agents by known bodies in which they are soluble would seem to be accomplished less rapidly and less effectively from the excised or dead organ than occurs by circulating through the structures media containing anæsthetics or other substances which are solvents for the lipoids. This might be interpreted as indicating that the change was partly metabolic and not purely chemical. If the stage which is now considered dependent upon excitability after the administration of an anæsthetic is really due to the abstraction of pressor substances from the adrenals or other structures then a new point of view is obtained.

ANNUAL ORATION.

DR. ASTLEY P. C. ASHHURST delivered the Annual Oration entitled "The Patience of Surgery."

STATED MEETING, HELD OCTOBER 3, 1910

The President, DR. ROBERT G. LE CONTE, in the Chair.

OSTEOMYELITIS OF THE SACRO-ILIAC ARTICULATION.

DR. JAMES K. YOUNG reported the history of a youth, aged 17 years, with good family history and without pulmonary or other inherited disease, who was admitted to the service of Dr. David Riesman at the Philadelphia Polyclinic, with the statement that the day after Christmas he fell while playing and injured his hip; two weeks later he had another fall, injuring his left hip, and five days previous to admission he had another fall from a wagon. Upon admission he complained of pain in the region of the left hip, and there were tenderness, heat, and deep fluctuation in this area. The leg could be moved without much difficulty. His condition not improving and a leucocyte count of 14,600 being found, the sacro-iliac joint was exposed, a portion of the ilium was removed, and the hip-joint was exposed, but no pus was found. Within six hours, however, suppuration became profuse and continued for several days. The cultures showed *Staphylococcus aureus*. His recovery was interrupted by an attack of orchitis. The case is reported on account of the rarity of acute suppurative conditions of this articulation and their recovery under treatment.

EARLY (TREVES) OPERATION FOR PSOAS ABSCESS.

DR. YOUNG also reported the history of a boy, aged seven years, family history negative for tuberculosis or other inherited disease, who, two days before admission to the Polyclinic Hospital, began to bend forward on the right side and to complain of pain in the right hip, with night-cries. Upon admission the right thigh was flexed, the movements of the right hip-joint were otherwise normal. There was tenderness in the right lumbar region with rigidity of the spine, but without any fulness in the iliac region. The osseous lesion of the spine was revealed by an X-ray, and the diagnosis of psoas abscess was made. The

abscess was opened by posterior dissection after the method of Treves, six days after admission. In three days the temperature was normal and in twelve days from time of operation the wound was healed and the patient was discharged from the hospital wearing a fixation apparatus.

SACRAL LAMINECTOMY FOR TUBERCULAR MONOPLÉGIA.

DR. YOUNG also reported the history of a man, aged 38 years, who was admitted to the Polyclinic Hospital under the service of Dr. David Riesman suffering from an atrophy and pressure palsy of the left leg. He stated that several years before he had been injured by a horse. There was prominence of the spinous processes of the sacrum, with tenderness over this region. A laminectomy was performed, removing the second and third laminae and exposing the nerves. An examination of this bone showed the presence of bony tuberculosis. The wound was an oval flap incision with the convexity upward in order to diminish infection, and primary union was secured. The operation removed the pain in this region, but pain in the lower extremity was not entirely relieved.

LACERATION OF THE AXILLARY PORTION OF THE CAPSULE OF THE SHOULDER-JOINT AS A FACTOR IN THE ETIOLOGY OF TRAUMATIC COMBINED PARALYSIS OF THE UPPER EXTREMITY.

BY T. TURNER THOMAS, M.D.,
OF PHILADELPHIA.

WE are all more or less familiar with those cases in which the upper extremity becomes partially powerless, the muscles, especially those about the shoulder, atrophied, and the shoulder and arm stiff and painful, from a trauma of the shoulder region. Among the neurologists, in particular, the tendency has been to ascribe them to a lesion of the brachial plexus, as in Erb's palsy, in which the trauma is localized to a point above the clavicle, where the nerve-fibres to the muscles usually found involved are grouped together (Erb's point). In the cases which I have in mind, scapulohumeral limitation of movement is associated, on account of which, I believe, many of them have been ascribed by surgeons, in particular, to inflammation in the subacromial or subdeltoid bursa. I have stated in detail elsewhere¹ that I do not believe they are best explained by the bursitis theory, which does not account for the loss of power, and the supporters of which admit that they have difficulty in explaining the pain frequently radiating down the arm. Codman² says that in some cases these secondary changes in the nerves and muscles almost amount to a real paralysis and simulate lesions of the brachial plexus or progressive muscular atrophy. Nerves may be ruptured but I believe that in most cases they are not. The basic lesion, in my opinion, is a more or less extensive laceration of the axillary portion of the capsule of the shoulder-joint, the lesion of an anterior dislocation of the shoulder.¹ The essential cause of the dislocation is forced abduction of the arm, the most free and least restricted move-

ment in this joint, and the movement most frequently exposed to severe violence and to the leverage of a fully extended and rigid upper extremity, as in falls on the hand. The chief resistance at the shoulder to movement beyond the physiological limit due to forced abduction is from the axillary portion of the capsule, which frequently tears in consequence. Often from such a force an anterior dislocation of the shoulder results, in many of which, as the arm immediately afterwards drops to the side of the body, spontaneous reduction takes place and the fact of the occurrence of the dislocation is never recognized. In probably a great many more, the tear in the capsule is not sufficient to permit a dislocation, and it then represents the lesion of a sprain, a condition which at the present time is practically never recognized as such. The lesion is deep seated and difficult to locate by the ordinary signs of a sprain. The patient does not recall that forced abduction was a factor in the causation of the symptoms, because of the excitement of the moment, and because immediately afterward the arm fell to the side of the body into the position of rest, of most complete relaxation of the torn portion of capsule and therefore of least pain, where he finds it when he begins to take account of what has happened.

Internal rotation further relaxes the injured portion of capsule, so that the patient soon learns to keep the forearm in front of the chest in the sling position. Abduction and external rotation, especially the former, drag upon the seat of trouble and are avoided so long, that when the pain subsides and the patient wishes to use the limb, he finds that he cannot move it far from the side, the torn portion of capsule having become contracted in its relaxed condition. The loss of power and the atrophy of the muscles of the shoulder and arm are due primarily, I believe, to the involvement of the nerves in the axilla by perineuritis and neuritis from the inflammatory conditions in the axilla, which are secondary to the lesions in and about the joint. The atrophy and loss of power are probably in part due to the resulting scapulohumeral limitation of movement, and I have thought that it was in part due to the limitation of movement per se, *i.e.*, that there resulted a certain

loss of balance in the functions of the muscles of the extremity because some of those at the shoulder were thrown out of action by the shortened capsule. This was suggested by an observation in one case, in which a considerable impairment of the movements of the hand disappeared on the day on which the scapulohumeral limitation of movement was broken under an anæsthetic and the arm dressed in full abduction. The patient was delighted to find that so quickly all of the movements and much of the power had returned to this hand. Nothing else had been done than to tear the shortened capsule that could explain the return of power in the hand, so that I could see no other explanation than that the scapulohumeral ankylosis alone had been in some way responsible for the weakened movements in the hand and perhaps for some of that in the forearm and arm.

I am not prepared to enter into a detailed discussion of an intricate and confused neurological question, but I have been impressed with an apparent similarity between these stiff and painful shoulders and some of those which are called, by the neurologists in particular, traumatic brachial paralyses; and I wish to offer a few facts which tend to show why they are often confused with each other. The surgeon is usually impressed most by the disturbances in the shoulder-joint, the neurologist by the loss of power in the muscles. The latter rarely takes into account the scapulohumeral ankylosis, occasionally referring to it vaguely as secondary to the condition of the nerves and muscles, that is, to contractures of muscles and ligaments.

Schulz³ made an interesting study of the late results in cases of dislocation of the shoulder which appeared in Küttner's clinic at Breslau during a period of five years. There were 160 cases, but a large number failed to return for re-examination, and some of the remainder were excluded because of the complications which existed. The late results in 54 uncomplicated (by any fracture, according to the X-ray, by myositis ossificans, or nerve paralysis) traumatic dislocations did not justify the prevailing tendency to give a favorable prognosis after reduction of a dislocation of the shoulder.

In only seven cases (13 per cent.) were there no disturbances of motion in the arm, no noteworthy diminution of strength, and no pain in bad weather. In 14 cases (26 per cent.) the movement was free, but the power in the arm was reduced at least a third, in most a half, and in one two-thirds. In 39 cases (75 per cent.) there was weakness in the arm, and in about a half of these there was more or less continual pain in the shoulder, which was so much worse in bad weather that it became necessary to suspend work. In many cases movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. Schulz says that the chief cause of these poor results is to be sought in the cicatricial contraction of the joint capsule and surrounding tissues.

Delbet⁴ and Cauchoix in a recent study account for what seems to me to be very much the same type of disturbances following dislocations of the shoulder, by assuming the existence of injuries to the nerves. They say that at first it was universally admitted that these nerve lesions were due to the wounding of the terminal trunks of the brachial plexus by the luxated humeral head, but that at the present time this conception is much combated, because the muscle groups paralyzed correspond not to the territory of innervation of a nerve but to that of a root. They consider it unnecessary to dispute all the theories which have been offered to explain how these paralyses are produced. It appears to me that we have, in these various theories referred to, an indication of the obscurity of the etiology of the loss of power frequently associated with dislocations of the shoulder. Delbet and Cauchoix consider that most authorities at the present time accept the theory of a radicular paralysis in most of the cases due to a trauma about the shoulder; and they divide the cases into those due to lesions of the roots of the plexus or radicular paralyses, those due to lesions of the plexus itself, and those due to lesions of the terminal branches of the plexus. The chief object of their work was to encourage early operation. In three cases they exposed the nerves in the axilla and freed them of adhesions. When the plexus or its roots are the seat of the lesion they

advise a similar operation above the clavicle. Vandebossche,⁵ in discussing traumatic radicular paralyses due to injuries about the shoulder, says that because of the multiplicity of the nerve lesions, their association with truncular lesions, and the fugaciousness of certain symptoms, the diagnosis of these paralyses is difficult to make, except at the beginning. He also favors operation in grave cases.

That the radicular and plexus lesions are considered as frequently being due to injuries of the shoulders other than dislocations is attested by the already extensive literature on the subject. Underlying all this discussion and confusion, and in my opinion accounting for it, is the difficulty in locating a nerve lesion, which can explain the great variety of the nerve manifestations presenting themselves in these cases. Originally, as stated by Delbet and Cauchoix, the tendency was to locate the lesion in the axilla, that is, that it was due to the trauma produced by the dislocated humeral head. This became untenable, because the distribution of the nervous disturbances was too extensive and varied to be accounted for by such isolated nerve lesions as could be expected from such a cause. In the search for a higher nerve lesion, the condition of the joint is generally ignored. I suspect that scapulo-humeral limitation of movement is nearly always present in these cases diagnosed as traumatic brachial paralyses, and if the various nerve symptoms which occur could be accounted for on the basis of the conditions existing in the axilla, a long step would be taken in the direction of clearing up the pathology. I have already shown that a sprain of the shoulder is probably common to those cases due to a wide variety of accidents to the shoulder region, and I have pointed out that the pathology of a sprain due to forced abduction at the shoulder is essentially the same as that of a dislocation of this joint.¹ The tear in the axillary portion of the capsule occurs in all, but is most extensive in the dislocation which may be regarded as the type. Hemorrhage must occur in every case and will vary with the number and size of the blood-vessels opened. Some of the large lymph trunks which are numerous here

may also be torn. The extensive opening into the joint is in the most dependent portion, so that the extravasated synovial fluid, blood, and lymph fall by gravity into the loose tissue of the axilla, which has been more or less displaced and lacerated in luxations by the head of the humerus. Ewald⁶ believes that traumatic myositis ossificans always occurs in muscles about joints, and is due to the effect of the escaping synovial fluid which infiltrates itself among the muscle-fibres. If this were true, the synovial fluid is capable of inducing a high degree of irritation. The presence of the blood, lymph, and synovial fluid in the axilla, where they surround and infiltrate the various branches of the brachial plexus, and the inflammatory reaction induced by their presence and the associated trauma can account for a marked degree of perineuritis and neuritis in some or all of the nerves in the axilla. According to the number of nerves thus involved and the degree of involvement, we may have a large variety of nervous manifestations, and we need not assume the existence of a direct trauma to the terminal branches of the brachial plexus, the plexus itself, or its roots to account for them. The evidence which I have examined, to my mind, does not seem to indicate that actual nerve rupture in dislocations is especially common. The most frequently ruptured nerve is evidently the circumflex, but I believe that in many of the cases in which the diagnosis is made of a paralysis of the deltoid from a rupture of the circumflex nerve, the nerve is not so much injured as inflamed or bound in cicatricial tissue. I believe also that the marked atrophy of the deltoid seen in these cases is the result, not so often of a complete or a partial rupture of this nerve as of the compression of the nerve by the extravasation and the associated neuritis and perineuritis, of the consequent adhesion, and of the scapulohumeral limitation of movement, which throws the deltoid out of action more than any other muscle because it is the great abductor of the arm.

Delbet and Cauchoux collected from the literature 33 cases in which symptoms of paralysis of the muscles of the upper extremity followed dislocations of the shoulder, and added two

of their own, with another case in which the paralytic condition followed a fracture of the surgical neck of the humerus. The evidence obtained from them, as these writers interpret it, pointed to traumatic lesions of the nerves; and in so far as it was demonstrated by operation and postmortem, it showed involvement of the nerves in the axilla in most cases. In my opinion, these cases can be best explained by the changes produced in the nerves by the inflammatory reaction induced by the extravasated blood, lymph, and synovial fluid, and the trauma of the neighboring tissues.

The autopsy in the case of Th. Anger, performed seven days after the accident, revealed a bloody extravasation of the circumflex nerve to an extent of 2 cm., at the site of the capsular tear and extending into the terminal branches of this nerve. (The circumflex nerve passes backward between the subscapularis and latissimus dorsi muscles, and for a short distance lies directly on the capsule in the immediate vicinity of the tear, so that it is particularly exposed to the exciting causes of inflammation already referred to.) Bardenheuer in operations found intraneurilemmatic effusions, which he thought were produced at the time of the rupture of the surrounding blood- and lymph-vessels. The condition of the nerves was distinctly inflammatory, and he considered it sufficient to cause the conductivity of the nerves to disappear by the compression which the inflammation exercised on the nerves. Nicaise found the circumflex nerve swollen, between the inferior borders of the subscapularis and teres minor muscles (the nerve here lies directly on the capsule), and the nerve was enclosed in a sheath of inflamed cellular tissue. The histological examination showed an intense perineuritis. In another case Nicaise found the circumflex nerve bound in dense cellular tissue, in front of the capsule. Panas found a roughening of the circumflex nerve. Vincent determined clinically a paralysis of the median and ulnar nerves, and the case coming to autopsy, he discovered these two nerves surrounded by a zone of thickened fibrous tissue separating the luxated humeral head from the second rib. Müller found a complete disappearance of the

axillary fat, which was replaced by resisting connective tissue. It was difficult to follow the nerves toward the summit of the axilla on account of their adhesions. In Wallis's case the terminal trunks of the brachial plexus were adherent to the periosteum of the humerus just below the surgical neck. Delbet and Cauchoix met with similar conditions in their own three cases.

There is little in these findings to show an actual rupture of the involved nerves, but much to indicate that they had been enveloped in a zone of inflammation due to the lesions in the surrounding structures produced by the dislocations. I believe we may fairly assume that the nerve lesions in those cases of paralysis from trauma about the shoulder, without dislocation, are of a similar character. That actual nerve rupture is not the rule in these cases, as I have seen them, is suggested by the fact that these paralyzes tend toward recovery. Either with the assistance of the physician or without it, persistent efforts are usually made to increase the movement in the joint, and this tends to lengthen the contracted tissues, to favor absorption of the inflammatory tissue, and to loosen adhesions, all of which favor a return of the nerves and muscles toward the normal. Many of them, however, fall far short of reaching the normal. Prolonged rest favors a more dense and persistent contraction of the tissues and a more permanent atrophy of the muscles and loss of power. There is a variety of these cases, in which the humeral head falls appreciably below the acromion process, leaving a distinct depression between the two. The joint becomes flail-like, the arm practically helpless, and to a less extent the forearm and hand. This condition is very serious, I believe permanent and sometimes progressive, although my experience with it has not been extensive enough to warrant a positive expression of opinion. I have purposely avoided discussing it here because it deserves more attention than I can give it now.

The following is the only case in which I have had the opportunity of observing the patient from the day of the accident. It presents a few features which are particularly interesting and instructive.

A colored man, fifty-six years old, on June 26, 1910, was found unconscious in the subway, where he was employed as a laborer, and in an unconscious and delirious condition he was brought to the University Hospital, where he was admitted to the service of Professor J. William White, to whom I am indebted for the privilege of reporting the case. Examination showed a cut over the right eye, a contusion on the back of the head, and subconjunctival ecchymosis of the right eye. The pupils were equal and reacted to light, and there was no bleeding from the nose or ears. On the following day on account of his delirium and outcries he was placed in a side room, and because of the violence with which he threw himself about, he was strapped down by the wrists and ankles. In going over the matter later with the interne and the attending nurse, both were positive as to the violence with which he threw about his two arms, and both were satisfied that there could have been no loss of power in them at that time. My own recollection of the patient's actions during my visits, and the fact that he had been strapped down by the wrists confirmed these statements. On the third day the unconsciousness had cleared slightly, and it was observed that he could not raise his left arm or forearm from the bed and that he had very little power in that hand. On the following day there was slight improvement in power in the hand and forearm, but he could not move his arm. On passive abduction at the shoulder after the arm passed a right angle, the patient, who was conscious enough by this time to appreciate it, complained of pain in the axilla and resisted the movement. There was also marked tenderness on pressure in the axilla. On full abduction there was observed a considerable but well-outlined swelling about on a level with the shoulder-joint. It suggested a hæmatoma. Although the mental condition improved very much, there was little change in the condition of the left upper extremity. On July 2, a neurological examination was made by Dr. J. W. McConnell, and the following facts noted: No disturbance of the pupils or of the sphincters. Patient complains of a sensation as if the left hand, forearm, and arm were asleep. The muscles of the whole extremity are extremely weak. Those of the right can be well performed except abduction, which when performed actively or passively, seems to cause considerable pain referred to the shoulder-joint. The same condition obtains on the left side with,

additionally, when the abduction is almost completed, a distinct swelling which appears just behind the pectoral border. This swelling is soft and not to be found on the right side under similar circumstances.

Individual movements can be made as follows: Extension, flexion, and abduction of the fingers of the left hand performed, but much less well than on the right side. Extension and flexion of the hand at the wrist-joint are less well performed than on the right, but better than the movements of the fingers. Pronation on the left side better performed than supination, but both movements better than on the right side. Flexion of the forearm gives distinct contraction of the biceps. Distinct contraction of the supinator longus but much less power than would be expected from such a contraction. Same is true of extension on this, the left side. Voluntary abduction of arm very slight. Attempt at adduction causes distinct movement of adductor muscles but very little movement of arm. Passive rotation of arm on its long axis is fairly well performed, and the excursion is quite as large as in the right arm. Electrical examination shows prompt galvanic response in normal series. There is an area of hypalgesia in left hand, including an area on the ulnar side of the dorsum of the hand up to the styloid process of the ulna and extending over to and including the third metacarpal (middle finger); also over the dorsal surface of the little finger and dorso-ulnar surface of the palm to the median line and fissure in palm, indicating the metacarpophalangeal articulations. Reflexes normal.

I had not observed any trouble with the right shoulder and arm until Dr. McConnell discovered it, nor did I know that the left was involved until the interne, Dr. Sprowl, called my attention to the weakness in the hand and forearm. I concluded that I was dealing with a bilateral tear of the axillary portion of the shoulder capsule. I endeavored to prevent contraction of the capsule by forcing once daily each arm into full abduction. Against the complaints of the patient I persisted in this effort for about two weeks, but the resistance and pain gradually increased and I concluded to give it up. The right shoulder now gave him most trouble, and the resistance was more marked than on the left side. Hoping to prevent further contraction of the capsule on this side, I fixed the shoulder by a plaster cast, with the arm at slightly less than a right angle. The cast was removed nine days later. The scapulohumeral limitation of movement and loss

of power in the arm were more marked than on the left side, on which the loss of power below in the hand and forearm was much more evident.

August 1: The patient had been receiving for several days in the orthopædic gymnasium massage and passive movements, but he now insisted on going home, which he was permitted to do. Although he promised to return for further treatment, he failed to do so.

That the paralysis in this case was not due, primarily, to a traumatic lesion of the brachial plexus, is shown by the fact that for about 48 hours the arms were moving about vigorously, and straps at the wrists were required to restrain them. The first evidence of loss of power was detected on the third day in the left extremity, that in the right arm not until about a week had passed. That the lesions which caused all the trouble were in the axillæ of both sides was clearly evident from the severe pain there on abduction of the arms and the associated scapulohumeral limitation of movement. The localized swelling in the left axilla suggesting a hæmatoma gradually disappeared and was no longer evident when the patient left the hospital. It indicated strongly that its location directly under the shoulder-joint was due to a tear of the axillary portion of the capsule and consisted of a collection of blood from torn vessels, possibly also of lymph and synovial fluid. The pressure of the extravasated material and inflammation about the nerves will account for the gradual development of the nerve symptoms, which appeared earlier on the side on which the extravasation was most marked. The whole clinical picture, to my mind, is one that can be accounted for only by an extensive tear of the axillary portion of the capsule on each side.

In connection with this case I would again call attention to Schulz's observations. Of the 160 dislocations of the shoulder, he studied only the 54 uncomplicated cases, *i.e.*, uncomplicated at the time of the dislocation and the reduction by any nerve paralysis. Therefore, the evidence of involvement of the nerves which developed later can be accounted for only by assuming that it was the result of, and secondary to, the joint condition, as in my case. Schulz so concluded.

Another similar condition, the pathology of which has never been satisfactorily explained, is the infantile obstetrical paralysis, or brachial birth palsy. Duchenne⁷ was one of the first to call attention to it. Unfortunately I have not been able to gain access to his contribution on this subject and the following is a translation of his conclusions by H. M. Thomas:⁸ "Certain violent obstetrical measures, which may be necessary during the difficult lowering of the arm after the body of the infant has been born, or the strong traction on the shoulder by a finger introduced in the shape of a hook in the axilla, after the head has been born, may at times produce a paralysis of the arm, localized in the deltoid, infraspinatus, and flexors of the forearm, and characterized by the falling of the arm close to the side of the body, the rotation of the arm inwards, and extension of the forearm on the arm. The prognosis of this paralysis is, in general, grave; it may be cured by local faradization, but if this is abandoned, it becomes incurable and produces atrophy of the member." Erb calls attention to the similarity between these cases and those in which the brachial plexus is injured in adults, and believes that they are due to pressure at Erb's point, situated 2 to 3 cm. above the clavicle and somewhat outwards from the posterior border of the sternocleidomastoid and just in front of the transverse process of the sixth cervical vertebra. Stimulation at this point produces a simultaneous contraction of the deltoid, biceps, brachialis anticus, and supinator longus (apparently usually also of the infraspinatus and subscapularis). Thomas says that, why such varying conditions as are known to produce the paralysis should always make pressure at this point, was not explained. Carter was the first to advance the theory that in the great majority of cases stretching of the upper roots of the brachial plexus, and not pressure on the plexus, was the cause of the paralysis. The latter view seems to be the generally accepted one at the present time. Schoemaker⁹ collected 95 cases from the literature, and of these, 55 were head presentations and 40 breech. Without going into such a general discussion as the question deserves, I wish merely to

call attention to a few facts, which will, I believe, justify the suggestion that a tear in the axillary portion of the capsule of the shoulder-joint may be the explanation of the condition found in many of these cases. Pressure at Erb's point has never been established as the cause. Stretching of the upper roots of the brachial plexus, with laceration, ought to produce more frequently a more complete and permanent paralysis than is exhibited in these cases. There is a difference of opinion as to the permanency of the paralysis, but most authorities consider that the majority of cases tend to recover more or less completely. The most positive evidence that I have found in favor of stretching of the roots of the plexus is that offered by Clark, Taylor, and Prout.¹⁰ It would seem, at first thought, that their evidence could not be controverted, yet it does not seem that operation for these cases is being generally adopted. Apparently the prime object of their work was to show that many or most of these cases could be cured only by operation. In seven cases seen within a period of two years, they excised portions of the involved roots and sutured the ends together. In one case the rupture involved the entire plexus. Five of the remaining six showed the maximum damage above the junction of the fifth and sixth cervical roots, and one below it. In one, the fifth root was found torn across, and the ends separated about 1 cm. and bound down by connective tissue. In one case the fifth root was torn across just below the junction, and the distal end displaced inward and downward about 2.5 cm. to the front of the scalenus anticus, where it was adherent. They do not refer to any cases not operated on, and one is in doubt as to whether they operated on all their cases. If they did, then they evidently regard the prognosis as more unfavorable than most authorities. In the discussion which followed the reading of Walton's paper,¹¹ before the American Neurological Association, it was developed that no neurologist present, except Lezynsky, had ever seen an obstetrical birth palsy in an adult. Lezynsky saw one at twenty years and another at seventeen years, in one of which there had been a dislocation at birth. He saw another case in a child in which

there had also been a dislocation at birth. According to the conception of the pathology entertained by Clark, Taylor, and Prout, the usual result of traction is to produce a tear in the perineural sheath, with a resulting small hemorrhage into and beneath the sheath and infiltrating the strands of nerve-fibres and the meshes of the epineurium. In all their operative cases they found the deep cervical fascia invariably thickened, especially over the plexus. An extravasation of blood, lymph, and synovial fluid, 4 or 5 inches upward under the clavicle, from an injured shoulder-joint, with the infant in the recumbent position, would more satisfactorily explain the thickening of the cervical fascia and the cicatricial tissue about the nerve-roots, than would a small tear in the perineural sheath or a rupture of one or two nerve-roots. If the continuity of a nerve-root was broken by traction, the divided ends would probably fall together again as soon as the traction was removed, when we would have a more perfect approximation than could be obtained by the most perfect suturing after the excision of a portion of the root. The cicatricial band of union between the ruptured ends might be difficult to locate and recognize months or years later, in an adherent mass of tissue. The question might fairly be raised as to how a separation of 2.5 cm. between the ends of the divided root is to be explained. In amputations we retrench the nerve-ends, because they do not tend to retract, and if not so treated are likely to become caught in the surrounding scar tissue. There is not enough movement of the surrounding structures to account for so much separation, and the contraction of the cicatricial tissue between the nerve-ends should draw them together. I should regard the theory that traction on the upper roots of the brachial plexus as the cause of these birth palsies is not yet established.

In a head presentation, when the head is born the next step is to deliver one arm, which then occupies a position of abduction. If the scapula did not move with the arm, this would be nearly the normal limit of abduction. Abduction beyond a right angle is permitted by movement of the scapula, which is

produced by tension on the corresponding muscles, and particularly on the axillary portion of the capsule. Traction on this arm to aid the delivery of the rest of the body must apply a dangerous force to the tense axillary portion of the delicate, infantile capsule. H. M. Thomas reports three cases.

The first was seen six weeks after birth. It was a head presentation and forceps delivery. The right arm was born first and traction was made on it. Paralysis of this arm was noticed soon after birth. In the second case, seen eight days after birth, the labor was normal up to the delivery of the head. The delivery of the shoulders was difficult. The anterior (left) shoulder was engaged under the symphysis and was delivered only after considerable difficulty. The head was depressed until this shoulder slipped under the symphysis and was delivered, when by elevating the head (thus forcing the left arm into extreme abduction), the other shoulder was delivered without much trouble. The left arm was paralyzed. It was observed of this case that the shoulder could not be abducted nor the arm rotated outward. In the third case, after a difficult forceps delivery of the head, the shoulders became fixed, and traction was made on the head flexed toward the right shoulder (evidently to deliver the left arm, which must have been forced further into abduction in the delivery of the opposite arm). It was the left arm that was paralyzed. In none of the three were the reactions of degeneration found.

I have referred to these cases because they present some evidence to show that forced abduction was employed in just the arm which was afterward found paralyzed. The most characteristic feature in cases due to a tear of the axillary portion of the shoulder-joint capsule is the scapulohumeral ankylosis, although, as already shown, it can easily be overlooked. If it were present in all birth palsies it would point very strongly to a capsule lesion as the cause of this condition. It cannot be accounted for on the basis of a rupture of the roots of the plexus. It was clearly present in Thomas's second case, it might have been in the others. Schoemaker reported two cases of his own. In one the affected arm was in marked internal rotation, and when it was raised and let go, it fell back. It is not stated that there was or was not resistance to abduction. In his second case, there was marked scapulohumeral ankylosis, almost complete. Duchenne called attention to the internal rotation of the arm, and it was present in all three

of Thomas's cases. It is explained on the basis of the paralysis of the external rotators of the humerus. The theory of a torn axillary portion of the capsule will explain it. Abduction and external rotation drag upon the lacerated capsule and thus produce pain in the early stages. Therefore, the arm is held in the position of rest, adduction, and internal rotation. Later from cicatricial contraction the ankylosis tends to become permanent. The results of treatment in Thomas's cases are suggestive of a capsule rather than a nerve lesion. He employed passive motion, massage, and the galvanic current. The first patient was found dead in bed with its mother three weeks after treatment was begun. In the second case (in ten weeks) and in the third (time not given), the child was practically well when the treatment was abandoned. The treatment was begun early, and in ten weeks the passive motion could have stretched the recent cicatricial tissue easily, and with the massage could have aided materially in the absorption of the reparative new tissue and adhesions of the nerves, the condition of which was probably improved by the electricity. An injury to the roots of the brachial plexus would probably not have recovered so quickly.

Guillemot¹² reports a remarkable series of 12 cases, observed between the ages of fourteen and twenty-five years. The histories showed that all had been delivered either by podalic version or by the breech, and by the same midwife. In 7 cases both arms were paralyzed and in 5, only one arm. Internal rotation was noted in 15 arms, and in 4 it was not observed. Scapulohumeral ankylosis was positive in 13 shoulders, slight in 1, and probably present in the remainder, judging from the associated statements. The paralysis was observed within a few days after birth in all but 2, and in connection with these no statement was made showing when it was first noted. In many of the cases there were associated joint lesions in the shoulders, elbows, and wrists, proving conclusively, says Guillemot, that strong traction must have been made on the arms in delivery. That the condition of the arms was not due to myelitis, was indicated by the fact that

in all, the patellar reflexes were normal and in none was there any weakness in the lower extremities. Sensation was better preserved than motion, and in several cases in which the paralysis was almost total, there was neither anæsthesia nor analgesia. In 11 cases the history pointed to a breech presentation. It will be recalled that of Schoemaker's 95 cases, 55 were head presentations and 40 breech, although for all labors the former are relatively much more common than the latter. The evident relationship between breech presentations and birth palsies has been explained upon the basis of the traction on the after-coming head, and consequently upon the cervical roots of the brachial plexus. It has been shown that the palsy frequently occurs when the birth has taken place without traction on the head. In a breech presentation, when the body is delivered the arms are forced into extreme abduction alongside of the after-coming head, and any turning of the body to one side or the other to assist in the delivery of one arm throws that arm into still more marked abduction. The danger to the capsule is then extreme, so that skill and care would be required to avoid its rupture. The associated joint lesions of the shoulders, elbows, and wrists proved conclusively that strong traction was made on the arms in delivery, as Guillemot said, not on the head.

The main point that I have tried to make is that the pathology underlying many of these brachial birth palsies is that of a dislocation of the shoulder, or its analogous condition, a sprain. The paper of Schulz and that of Delbet and Cauchoix emphasize the importance of the dislocation, in similar cases not occurring immediately after birth. I believe that a careful search of the literature would show that it bears an equally important relation to the birth palsies. Lewis¹³ reported a case, which had been diagnosed as a birth palsy and in which a posterior dislocation was recognized and reduced. The patient recovered full use of the arm. Young¹⁴ reported a similar case and directed attention to the frequency with which dislocation of the shoulder is mistaken for birth palsy. He adds that if the dislocation is allowed to continue it will produce a pressure palsy resembling a birth palsy.

Through the kindness of Dr. R. H. McCombs, registrar of the Children's Hospital of Philadelphia, I was enabled to trace a case of brachial birth palsy, which had appeared at the dispensary of this institution, July 18, 1906, when three years of age, on account of an inguinal hernia. It was noted in the history that the patient had a birth palsy of the right arm. He never returned to the dispensary. He is now seven years old. From the mother I learned that instruments had been employed at birth, and that the left humerus and the right clavicle had been fractured, showing that strong traction had probably been made on the arms in delivery. On the following day the right arm was observed to hang helpless at the side. At two months of age, he was taken to a nervous dispensary of another hospital, where the attending physicians are particularly competent to recognize a birth palsy. The visits were not continued long, as the child was too young. At eight months, he was taken back to the same hospital, and again received electrical treatment, which seemed to indicate that a diagnosis of birth palsy had been made, but the mother was never told what was wrong with the arm. When I found him, recently, the arm was hanging at the side, rotated internally, and considerably shorter than the opposite arm (see Figs. 1 and 2). He had regained considerable power, and could abduct the arm to an angle of about 140 degrees. The limitation was due chiefly to a mechanical obstruction at the shoulder, but for which he could probably have raised his arm in full abduction. There was a well-marked wrist-drop and an evident atrophy of the deltoid. Dr. J. W. McConnell, by electrical examination, found a paralysis of the musculospiral nerve. The parents had never been told by any one that the child had a dislocation of the shoulder. Upon inspection the picture was that of a brachial birth palsy, but after palpating the shoulder carefully because of a peculiarity in its shape, I detected a subacromial dislocation. The humeral head could be pushed forward, evidently into the glenoid cavity, but not as far forward as normally. It would not stay in this position if the pressure was removed, and could not easily be held there when the boy abducted or adducted his arm. It seemed to be more easily fixed in the normal position when the arm was in abduction. The patient's brother, now about twenty-five years of age, insisted that he had observed from the birth of the patient that the shoulder was out of place.

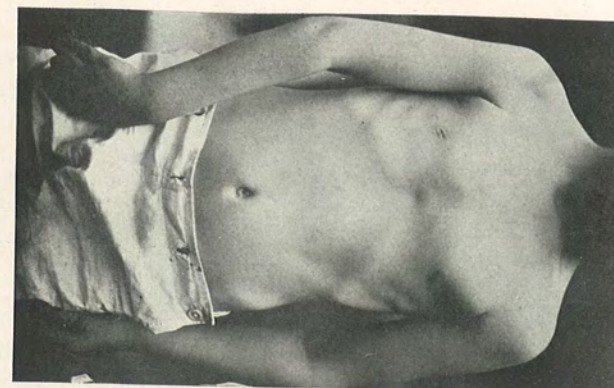


FIG. 1.

Subacromial dislocation of right shoulder with paralysis of musculospiral nerve. Anterior view. The wrist-drop, shortening of limb, and internal rotation of arm are shown. There is an abnormal prominence at the site of the old fracture of the clavicle.

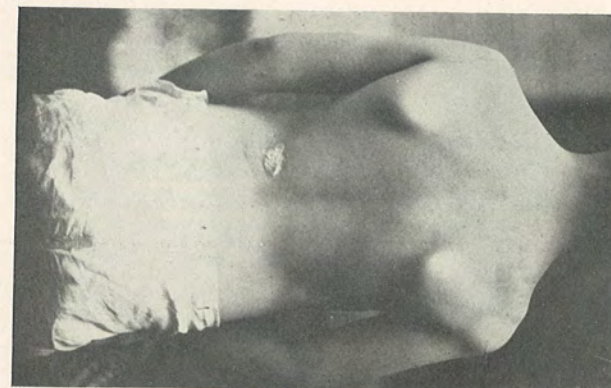


FIG. 2.

Posterior view. A abnormal prominence produced by dislocated humeral head. Position of hand shows internal rotation of arm.

On October 28, 1910, he was admitted to the service of Professor J. William White, in the University Hospital, and on the following day I operated on him. The incision was made along the posterior border of the deltoid, which was retracted upward. The tendon of the infraspinatus muscle was divided transversely, the capsule exposed, and the joint opened. The glenoid surface had not the normal cup shape, but was rather convex, with a tendency to slope backward, favoring the slipping posteriorly of the humeral head into the dislocated position. The head was placed in its normal position and the arm held at a right angle with the body while the capsule was shortened to hold the head in this position. The infraspinatus tendon was repaired by suture, and the wound closed without drainage. After the dressings were applied the arm was fixed in nearly full abduction by a light plaster cast, and an opening left through which the wound could be exposed. Healing occurred by first intention and the skin sutures were removed on the seventh day. On about the twelfth day the patient developed symptoms of scarlet fever and was removed to the Municipal Hospital. The cast was there removed two weeks after operation. In about a week the arm could be brought to the side of the body, and the patient was permitted to use it as he lay in bed. On September 2, I saw him at the Municipal Hospital, and then observed that the dislocation was recurring, the tendency of the humeral head being to force its way back to the dislocated position, probably on account of the abnormal shape of the glenoid cup. There was evident at this time a marked improvement in the muscles supplied by the musculospiral nerve, as shown by the disappearance of the wrist-drop. When both arms were held out from the body, the hand on the affected side was held in exactly the same position as on the sound side, *i.e.*, with the palms facing downwards, both hands were in dorsal flexion at the wrist and on the affected side was held in this position without any apparent difficulty. I believe that this degree of improvement in the musculospiral nerve, during the few weeks in which the humeral head was kept in the normal position and the nerve thus probably relieved of abnormal pressure, proves that if the humeral head can be kept in its normal place the arm will become much stronger and a very useful member.

We have here another case like those of Lewis and of Young, in which a posterior dislocation of the shoulder occurring at birth was mistaken for a birth palsy. The clinical picture of birth palsy was present in all three. They show, I believe, that there is a close etiological relationship between the two conditions.

Similar palsies in the adult, from trauma about the shoulder, are due in the great majority of cases, I believe, to tears of the axillary portion of the capsule. While probably true, this is not so clear in the accidents of birth involving the upper extremity. Forced abduction tends to produce an anterior dislocation, but that occurring at birth is almost always posterior. Forced abduction tears the axillary portion of the capsule, but what is the relation between this and a posterior dislocation which must tear the posterior portion also? The following explanation may have some value. There is one important difference in the forced abduction applied to the infant's arm at birth and that applied to the arm in the usual accidents in adults. In the adult the limb is used for defense and is placed or employed by the patient himself, according to the nature of the accident. In the infant at birth, the limb is used as an aid in delivery and is controlled by a second person. In a fall on the hand, which is probably the most frequent cause of dislocations of the shoulder in adults, we have, in addition to the forced abduction, a push in the long axis of the limb in the direction of the shoulder. At birth, assuming that traction on the arm is the cause of the dislocation, we have, in addition to the forced abduction, a pull in the long axis of the limb, away from the shoulder, a force directly the opposite to that sustained in a fall on the hand which produces an anterior dislocation. Since the long axis of the glenoid cavity is oblique from above downward, a strong pull on the fully abducted arm should tend to produce an upward and backward dislocation.

The three cases I have referred to would seem to indicate that a posterior dislocation of the shoulder in the new-born is usually associated with a palsy. If the same condition developed in the absence of a dislocation it would probably be called

a birth palsy. Why not in the presence of a dislocation? Stimson says that paralytic dislocations of the shoulder are particularly frequent in the new-born, and that Duchenne saw eight of this kind in ten years. Panas quotes Duchenne as saying that before his attention was attracted to this complication, he had overlooked it in other cases. According to Panas, Duchenne called attention to the fact that there was diminution of electrical contractility and atrophy of the muscles supplied by the musculospiral and ulnar nerves in these cases. As already stated, I have failed to obtain access to Duchenne's contribution on this subject. In my opinion, there is room for question as to whether all of these dislocations are paralytic, *i.e.*, that the dislocations are the result of associated paralysis. I believe that in my case it was not, but that the paralysis was the result of the dislocation. The reduction of the dislocation in the case of Lewis and in that of Young was followed by a disappearance of the paralysis. In my case the dislocation has existed so long that more or less permanent changes may have taken place in the nerves and muscles, and a return to the normal may be impossible. The prompt improvement following operation, however, is very encouraging. I believe, however, that if the dislocation had been recognized at birth or soon afterwards and had then been reduced, a complete cure would probably have followed. The only positive nerve paralysis at the present time, after the dislocation has existed seven years, is in the musculospiral. Could the dislocation be responsible for this isolated paralysis? The course of this nerve and its relation to the humerus is peculiar to it. In the lower part of the axilla, it begins to pass backward, and then passes obliquely around the upper half of the humerus close to the bone. The backward dislocation of the upper end of the humerus forces the nerve backward with it and must exert an abnormal compression on it, the seven years' existence of which might be responsible for the present condition of the nerve and the muscles it supplies. The results of operation in this case would seem to support this view. Those cases in which there is a depression between the acromion and the humeral head, the

joint flail, and the muscles paralytic, are relatively common soon after birth, but as already stated I expect to take up this subject in another paper, so that I shall avoid its discussion now.

Believing as I do, that in tears of the axillary portion of the shoulder capsule we have a hitherto unrecognized cause of many nervous disturbances in the upper extremity, the pathology of which has been in doubt, I feel justified in suggesting a possible relationship between this injury and some of the craft palsies. In a previous paper¹ I reported a case of stiff and painful shoulder with loss of power in the arm, in which diagnoses of neuritis and of osteo-arthritis were made. The patient is a well-educated man, who was disposed to investigate and to interpret, so far as possible, the meaning and cause of the symptoms of his condition. He was first in the hands of a physician for some months, who was anxious to discover the underlying cause of the trouble, and I had examined the arm for the first time; yet none of us had suspected the existence of the marked scapulohumeral ankylosis, the gradual elimination of which was followed by a disappearance of all the troublesome symptoms. In connection with this case we might consider the one previously mentioned, in which the palsied hand movements returned almost to the normal, so far as freedom of movement was concerned, immediately after the tearing of the contracted portion of the shoulder capsule. If in the second case, as in the first, the trouble in the shoulder had not been recognized, and the patient had been a clerk whose livelihood depended upon the use of his hand in writing, I can imagine the weakness in the hand attracting most attention. I have already reported a case, in which both shoulders were stiff and painful from rheumatism, and in which in one arm a diagnosis of writer's cramp was first made, then of neuritis of the arm by another physician, and of dislocation of the shoulder by a third physician, which was probably the cause of the aggravated condition in that arm. Turner and Stewart¹⁵ say that in some cases the pain is occasionally severe, and affects the upper arm and shoulder as well as the forearm and wrist. They also say that examples of occupation neurosis are

seen in men who undergo repeatedly muscular efforts, as blacksmiths, in whom the upper arm and shoulder muscles, especially the triceps and deltoid, are implicated. Poore¹⁶ says that he recalls cases of writer's cramp in which excessive efforts with a crow-bar, pulling hard upon a rope on board ship, wringing of clothes, and severe traction on one arm while getting off an omnibus in motion were each followed by an inability to perform delicate acts. In the discussion which followed the reading of a paper by Poore¹⁷ on writer's cramp, Godlee referred to a case which had a clicking in the shoulder and a good deal of pain, apparently muscular. The shoulder was supposed to be diseased, as the result of an injury, but Godlee could not make it out as diseased. It would seem, therefore, that many of the craft palsies are distinctly traumatic in origin. It will be recalled that in many of Schulz's cases, which followed dislocations of the shoulder, movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. It is not necessary that the scapulohumeral ankylosis be marked, to be associated with severe pain and weakness in the arm as I have seen in one case. The blood, lymph, and synovial fluid, which extravasated about the large nerve-trunks soon after the original accident, may have induced sufficient adhesions about them to interfere with their functions, and therefore with the functions of the muscles they supply; or as already stated, the weakness in the extremity, including the hand, may be due to the limitation of motion at the shoulder. Erb says of these cases that electrical examination, as a rule, shows no noteworthy changes, and that we are still very much in the dark with regard to their real nature.

The following case, seen recently with Dr. R. S. Dorsett, is very suggestive. The patient, a trained nurse, was thrown violently in a street car collision, striking, she says, against her right shoulder. In consequence she suffered severe pain in various parts of the body, but particularly in her left arm, left leg, and in the back between the scapulæ. I saw her for the first time 26 days after the accident. She then had considerable ten-

derness on pressure between the scapulæ, and since the accident had suffered from pain and numbness in the left upper extremity from the shoulder to the hand, where it involved the three fingers on the ulnar side. An important part of her work is the giving of massage and her chief complaint at the present time is that the loss of power in the left hand interferes with her ability to perform the massage movements. She is very much worried also because, from time to time quite unconsciously, she drops objects from her hand, such as a drinking glass, recognizing the fact only when the crash of the fallen object is heard. In order to establish or exclude a tear of the axillary portion of the capsule, the first symptom I looked for was scapulohumeral limitation of movement, and I found that full movement at this joint could be performed, actively as well as passively. It was not until a week later, on her second visit, that it occurred to me to ask if there had been any pain on movement in the shoulder, and she then stated that she had had much trouble in this respect, but that she had persisted constantly since the accident in forcing the painful and limited abduction. It was only for a few days before her first visit to me that she had been able to perform the full movement. I diagnosed a slight tear of the capsule on the left side, with the possibility of a similar but still milder lesion on the right side. The tenderness between the scapulæ was over the back muscles, which would most resist the associated movements of the scapulæ in forced abduction at the shoulder, which I believe occurred in the original accident. There was more acute tenderness in the left axilla directly under the joint than anywhere else in the body, and I thought that there was still a slight trace of ecchymosis in this axilla, more than three weeks after the accident. About six weeks after the last visit she returned and complained that she could not voluntarily abduct the arm beyond a right angle. On account of pain in the shoulder she had neglected to continue the forced exercises, and the recurrence of the scapulohumeral limitation was the result. The pain and numbness down the arm and forearm to the hand, and the loss of power in the hand, could be satisfactorily explained by a perineuritis and neuritis of some of the branches of the brachial plexus, particularly of the ulnar nerve, due to inclusion in the inflammatory area adjacent to a tear in the axillary portion of the shoulder capsule.

The important fact here is that, four weeks after the accident, when there was little or nothing to suggest a nerve lesion in the axilla, the palsy of the hand should be so marked as to seriously impair her ability to follow her usual occupation, and to cause her to drop such light objects as a drinking glass. There is no doubt in my mind that the weakness in the hand was due to the shoulder-joint lesion, and it seems to me that the case might be classed with the craft palsies. The patient did not associate the hand weakness with the shoulder condition, but regarded it as one of a number of isolated effects of the accident, among which are the pain in the leg, in the back, about the shoulder, and the pain and numbness in the arm and forearm.

Concerning the treatment of these cases, I would place the emphasis first on overcoming the scapulohumeral limitation of movement by suitable exercises and massage, the condition of the nerves and muscles at the same time being improved by electrical stimulation. I would prefer to delay the final determination of the presence or absence of an actual rupture of nerve-fibres and the localization of such a lesion until the movements of the shoulder-joint were normal and the effects of compression or adhesions of nerves had been eliminated. The early recognition of a joint lesion and the associated axillary inflammation is of the greatest importance, but it is likely that the majority of the cases will continue to escape recognition until the conditions become chronic. I have gone over the treatment more fully elsewhere¹⁹ and will now only briefly review it.

In the acute stage, the severity of the pain on movement may demand immobilization of the shoulder-joint. This is done preferably with the arm in full abduction, to prevent contraction of the torn capsule during the healing process, which should be complete in two weeks. This position is awkward, uncomfortable, and difficult to maintain, but the result is well worth the trouble it involves. The Monk splint modified by Codman² is a good one for the purpose. A light plaster cast, including the upper part of the chest and arm to the elbow, will

permit more complete abduction, more complete rest of the joint, and will not require as much care as the splint. If there has been a dislocation of the shoulder, it will probably be safest to bind the arm at the side, for three weeks, although I believe that a recurrence could be prevented with proper support by adhesive plaster and a splint which would hold the arm at a right angle with the body. The studies of Schulz show, in my opinion, that the fear of a recurrent dislocation is chiefly responsible for the frequent long-continued stiffness of the shoulder-joint and loss of power in the extremity. I believe that we should balance the one danger against the other, and that with due precautions we can largely eliminate both. At the end of two weeks' immobilization, when there has been no dislocation, the arm should be gradually brought to the side of the body, after which massage and passive movements should be employed to bring about an absorption of the inflammatory material in the axilla, the release of any adhesions which the nerves and other structures have contracted, and thus the return of motion in the joint and of power in the muscles. Electrical stimulation will aid in the more rapid return of the nerves and muscles to the normal.

If the patient is young, strong, and ambitious, the awkwardness of the fixation of the arm in the abducted position may be avoided by permitting him to keep the arm at the side, but with the understanding that forcible exercises are to be employed as soon as the pain will permit and before contraction of the cicatricial tissue sets in. Most cases are first recognized as a serious condition in the chronic stage, when the cicatricial tissue in the axilla is firmly contracted and very resistant. Persistent and long-continued massage and forced movements may gradually stretch the contracted capsule to its normal length, but this will take such a long time that most patients will become discouraged and give up the treatment before it has accomplished the desired result. The breaking up of the resistance under an anæsthetic at one sitting, and the employment of measures to prevent a recontraction of the torn tissues have been very successful in the hands of a few men. Küster

ter¹⁸ found it necessary to repeat the breaking up process frequently in some cases, but this was evidently because he dressed the arm at the side of the body afterwards and permitted the recontraction of the capsule, which could then, however, be stretched more easily because the inflammatory material was more recent and yielding than before the manipulations had been carried out. Küster regarded some very old cases as intractable. I have used this treatment in four cases with very satisfactory results and have not found it necessary to anæsthetize the patient the second time, and I believe that the method will be successful, however old the condition may be. The same efforts as in the acute stage must be made to maintain abduction or to overcome any recontraction, because what we accomplish by the forced manipulations is to produce essentially the same conditions as existed immediately after the original accident.

There are some cases in which the chief complaints are of pain radiating down the arm and loss of power, and in which the movement of the shoulder is so free as to cause a slight scapulohumeral limitation of movement to be overlooked. These are particularly likely to pass for cases of neuritis. In one case of this kind I was satisfied that there was slight abnormal movement of the scapula on passive abduction, and that a contracted axillary portion of the capsule with associated adhesions of the neighboring nerves was responsible for the trouble, which had persisted for eight months and had prevented the patient from following his usual occupation, that of a machinist. Under an anæsthetic I forced the arm into full abduction at the shoulder, with the usual tearing sensation, fixed it in abduction on a splint for a few days, and afterwards forced it twice daily into full abduction. Massage was employed daily, and in six weeks he had obtained nearly full motion, much improvement in power, and was able to return to work at his trade. The slightly contracted capsule was in all probability responsible for most of his trouble. It has not been convenient to employ electricity in some of my cases, but where I have used it there has seemed to be a more rapid return

of power in the weakened muscles. Whenever there is, in the muscles, an impairment of irritability to the electric current, its advantages are obvious.

In connection with the brachial obstetrical palsies, I have had only small experience, but I have been impressed with the idea that care is necessary in differentiating the various cases. I am convinced that subacromial dislocations frequently co-exist and are overlooked, and that they are probably birth palsies as much as those in which there are no dislocations. I believe that the dislocation had not been recognized in my case before I saw it. The prompt improvement in the condition of the paralyzed muscles after the imperfect result of the operation proves, I believe, that if the humeral head can be kept in its normal position without impairment of the movement of the joint, the condition of the muscles and nerves will return almost to normal. If the dislocation had been reduced soon after birth, when the glenoid cavity had its normal conformation, in all probability it would have remained in place, and, after a longer or shorter period of "paralytic" symptoms such as probably follow all dislocations and vary according to the degree of involvement of the neighboring nerves by the surrounding inflammation and the effects of later adhesions and compression, the arm would have gradually returned to its normal condition. I would interpret the existence of a scapulo-humeral ankylosis in a case of infantile obstetrical palsy to mean that the cause of the paralysis was below the clavicle, not above it. The treatment in such cases should aim at improving the motion of the joint, and in this way releasing the adjacent nerves from the effects of the adhesions and compression which interfere with their function. Electrical stimulation and massage are important in improving the condition of the arm. If after the normal joint motion has been obtained and a reasonable period has been allowed for recovery of the nerves, the paralysis is still of such a character as to justify the diagnosis of a permanent paralysis of one or more nerves below or above the clavicle, the advisability of an operation to free the nerves of their adhesions or to excise a portion and suture the divided ends together may be considered.

CONCLUSIONS.

Extensive laceration of the axillary portion of the capsule of the shoulder always occurs in anterior dislocations of this joint, which represent practically half of all the dislocations of the body. Probably, while the arm is in forced abduction, many others occur, which are spontaneously reduced as the arm falls by gravity to the side of the body immediately after the accident, and the fact of their occurrence is never recognized. Just as the milder lesion, the sprain, is more common at the ankle and wrist than the fracture, which results from a similar but more severe force, so, in all probability, are the sprains at the shoulder more common than the dislocations. We can thus account for a large number of cases in which the same capsule tear occurs.

The extravasation of blood, lymph, and synovial fluid, resulting from such a lesion, falls by gravity into the loose tissues of the axilla, where they surround and infiltrate some or all of the branches of the brachial plexus, giving rise to a non-infectious inflammation, which adds to the already existing compression of the nerves and induces a perineuritis and neuritis. The interference with the function of the nerves caused by these conditions can account for the multiplicity of the nerve symptoms and the fugaciousness of certain symptoms, so that one need not assume the existence of a traumatic lesion of the brachial plexus, its roots, or its branches, to account for them. The post-mortem and operative findings in Delbet and Cauchoix's cases, and the clinical findings in Schulz's cases, support this pathogenesis.

The infantile obstetrical palsies, in which one or both upper extremities are involved, may be the result of a similar axillary condition. This implies that forced abduction of the arm, with or without traction on it and not traction on the head, is the important causal factor. Dislocations at birth give rise to similar palsies, and in these capsule tears undoubtedly occur. The palsies associated with these dislocations are probably completely curable by the recognition and reduction of the dislocations soon after birth.

We may have in unrecognized capsule tears the pathological explanation of many craft palsies. In this connection they at least deserve further consideration.

In traumatic brachial paralyses in adults, in infantile obstetrical, and in craft palsies, the shoulder-joint should be examined for a traumatic lesion, and if evidence of it is discovered, such as a scapulohumeral limitation of movement, the first therapeutic efforts should be directed towards obtaining a return of normal motion in the joint. Operations on the brachial plexus, its roots, or its branches should be deferred until a paralysis from inclusion of the nerves in cicatricial tissue has been eliminated.

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DR. JAMES K. YOUNG said that where children have had a palsy of the upper extremity due to subglenoid dislocation of the head of the humerus, this condition is usually mistaken for nerve palsy, but he had frequently discovered the condition to be due to a dislocation at birth, which had persisted. In one case seen by him, in a very small child, the examination was not very satisfactory, but it was shown to be a subglenoid dislocation. In some cases there has been complete restoration of function, in others but partial restoration. After reduction of the shoulder

there is often difficulty with the elbow-joint for some anatomical reason, so that sometimes he had had to also reduce the elbow-joint after reducing the shoulder-joint.

He had performed other operations of this character on three occasions. He had opened the capsule posteriorly and shortened it, making it smaller laterally. This is an original operation, and is not difficult either anteriorly or posteriorly. The capsule is opened by longitudinal incision and a portion removed or folded in and sutured together. The suturing of the capsule is important to maintain the position of the shoulder-joint. He had also removed the tendency to dislocation by division of the contracted muscles. After reduction and shortening of the capsule, the head of the bone should lie in good position without much force. It should remain in position after reduction, and there should be no pulling on the muscles or ligaments, all being so free that the joint remains in position without their aid.

DR. T. TURNER THOMAS presented the boy with paralysis of the arm developing at birth, referred to in his paper. He found an overlooked subacromial dislocation of the shoulder, which he reduced by operation. In this case when he got his finger inside the joint, the glenoid surface was felt to be abnormal. That is, it was more or less convex, with an inclination from the anterior toward the posterior edge, tending to favor the sliding out of the head from its normal position. Yet this was not very marked. He wanted to see what a shortening of the capsule would do. In the two months since the operation, the dislocation has been recurring. The point had impressed him that the head ought to lie in place easily and it should not be necessary to depend upon the soft tissues to hold it in afterwards. In this case, however, it tended to force itself out, although it is not now out as far as previously by a good deal. He now proposes, if he can obtain permission, to do what a German surgeon, Hildebrand, did in two recurring dislocations of the shoulder, in which the anterior portion of the glenoid process was absent. The head tended to slide out of the socket anteriorly, so he chiselled away the posterior margin until he made a new socket with a raised anterior margin. Dr. Thomas would try to go in through the axilla and make a new socket in this case, so that the head would stay in place without pressure

upon the ligaments. The striking improvement in the condition of the musculospiral nerve in the short time in which the head was kept in its normal place, leads to the hope that if the head can be kept in place permanently, the boy will obtain a much more useful arm than he has at present.

DR. ASTLEY P. C. ASHHURST reported the following cases from the services of Drs. G. G. Davis and C. H. Frazier, in the Episcopal Hospital.

I. APPENDICITIS COMPLICATED BY SUBPHRENIC ABSCESS.

Lucy G., age 31 years, negro, admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 28, 1907. During the night of Dec. 26-27 the patient awoke with epigastric pain, which later centred around the umbilicus. She worked at general housework all morning. She took salts, which made her vomit. She went to bed at 2 P.M. Six enemas were administered, but they had no effect. The next day (Dec. 28), the patient was sent to the Episcopal Hospital.

On admission it was learned that the patient is married, has had two children, the last five years ago. For several years, and until five years ago, had almost constant indigestion, which was attributed to rich food. No indigestion for last five years. Never seriously ill before.

Examination.—Temperature 101° F.; pulse 124; white blood-cells 15,000. Abdomen distended all over and rigid, but especially on right, and more so in upper than in lower quadrant. Very tender everywhere, including *both flanks*. Dulness in right flank. Liver dulness extends a little higher than normal. On percussion, stomach is found distended, and transverse colon is at level of navel. Has not vomited since taking salts the previous morning. No bowel movement since illness began.

Operation.—Forty-four hours after onset of illness an incision was made through the right rectus, above the navel; free pus was revealed on incising the peritoneum. The incision was enlarged up to costal margin; more and more pus kept coming from right flank and from above the transverse colon. Gall-bladder distended, but otherwise normal. Lymph around cystic duct, pylorus, and on anterior wall of stomach. When field

of operation was almost dry, suddenly there came a new flood of pus from above the right lobe of the liver, just beneath the diaphragm; this pus was full of flakes of lymph. When it was all sponged away, the margin of the ruptured adhesions which formed the subphrenic abscess could be clearly seen on the convex surface of the liver. Counter-incision was made for drainage just above the tip of the twelfth rib, and a split rubber tube, filled with gauze, was passed from the abdominal to the lumbar incision. Sand pillow was now placed under lumbar spine; palpation showed no abscess of liver, no opening in diaphragm (as from empyema), no signs of psoas abscess, or caries of spine. Further search along cystic duct, duodenum, and stomach showed no perforation. Finger passed through adhesions around foramen of Winslow showed no pus or gastric contents in lesser peritoneal cavity. Right flank and gall-bladder region remained dry. Gauze drain placed to neck of gall-bladder. The appendix was found on outer side of cæcum, pointing up to flank; it felt very hard and thick. It was acutely flexed on itself about its middle, and its distal half was gangrenous and perforated. Its base was delivered, ligated, divided, and carbolized, but not buried in cæcum; meso-appendix then ligated, and appendix removed. The raw surface left on the ascending colon, between the wide-spread layers of divided meso-appendix, was partly covered in by sutures. Omentum was scanty and *very slimy*. Glass tube showed the pelvis full of pus. Pelvis was drained by glass tube through suprapubic stab wound. Main incision in right rectus (about six inches) closed in layers except at middle, where drains emerged. Time, one hour. Condition good at end of operation.

Head of bed raised, and continuous proctoclysis ordered. December 29: temperature 98.8° F. Abdomen not rigid. No vomiting. A little tearing pain now and then. December 30: temperature 99° F. Doing well. December 31: temperature rose to 101° at 8 P.M. No abdominal symptoms. January 1: temperature 105° F., patient dying. Glass tube replaced by rubber, and new gauze wick inserted beneath liver. No cause found for symptoms. Death at 2 P.M., nearly four days after operation.

Exploration of wound after death showed no pus in upper right quadrant. Lymph and adhesions beneath transverse mesocolon to

left of origin of jejunum, showing the peritonitis to have been very wide-spread at one time. Most of jejunum and ileum were entirely normal. Stump of appendix in good condition. No perforation of stomach or duodenum; gall-bladder normal. Lesser peritoneal cavity shut off by adhesions and not affected. Drainage tube to pouch of Douglas had drained it perfectly dry; there was no pus at all in the pelvis, but a loop of lower ileum was adherent to uterus and bladder, and an abscess containing several ounces of pus had formed between these *in front of uterus*. This was a space which had not been drained. Death evidently occurred from a terminal infection arising in this abscess.

The attack evidently started as an acute appendicitis, pus forming in right flank and pelvis, and extending from right flank to subphrenic region, and from pelvis to left flank and general peritoneal cavity.

II. APPENDICITIS FOLLOWED AFTER SIX MONTHS BY SUBPHRENIC ABSCESS.

Orion L., age 17 years, was admitted to Dr. Davis's service in the Episcopal Hospital March 23, 1908, with a history of being ill for three days with appendicitis. Had a similar attack one year ago. When admitted he had a temperature of 103° F., and a pulse of 128. Abdomen was rigid in right iliac and suprapubic regions, and extremely tender in both places. Not tender in either flank. No mass, no dullness.

Operation, 9.20 P.M. (on third day of illness). Transverse incision (G. G. Davis: *Trans. Phila. Acad. Surg.*, 1906, viii, 160), two inches; on opening peritoneum free pus was found, with no adhesions. Appendix delivered. It was short, sub-cæcal, much twisted on itself, perforated at its tip, and there was a concretion loose in the abdominal cavity. Appendix removed, stump ligated, and buried in cæcum. Cæcum friable and spotted with lymph. Omentum not seen; glass tube and gauze drain to pelvis. Another gauze strip to right flank, as there was pus here also. In all, seven or eight ounces of pus were evacuated. No record of culture. Inner half of wound closed in layers. Time of operation, 20 minutes.

The appendix was gangrenous, and contained, in addition

to the concretion which had escaped from the perforation at its tip, also another concretion, with a stricture each side of its bed; the thickness of the walls of appendix gave evidence of the former attack. Patient kept sitting up in bed, and given continuous enteroclysis. Subsequent wound healing uneventful.

April 2 and 3: slight fecal discharge from wound. April 22: up in wheel chair. On May 2, was discharged; wound firm, only superficial granulating area.

Sept. 26, 1908, he was re-admitted to Dr. Deaver's service, Episcopal Hospital, complaining of pain in abdomen and right side. In July (two months after discharge) began to have pain in back, especially over eleventh right rib, in posterior axillary line. Pain was considered rheumatic. It has continued to the present. Liniments and belladonna plasters were tried but without effect. Two weeks ago began to feel worse, and confined to bed for last week; several sweats at night, and one chill. Pain in back increased and began to affect abdomen. Was treated for malaria.

He was emaciated, sallow looking; temperature 104.2° F.; pulse 112; respiration 26. A bulging, tender area over lower right ribs, in posterior axillary line. Scar of appendix operation firm, no hernia.

Operation, Sept. 26, 1908, Dr. Deaver: Incision in tenth intercostal space opened into abscess extending between liver and diaphragm, and along thoracic and abdominal walls down to cæcal region. Drain: two rubber tubes, one to cæcum, one between liver and diaphragm. Culture of pus negative. October 2: tubes removed. October 8: temperature normal. October 10: in wheel chair. October 19: discharged.

III. APPENDICITIS COMPLICATED BY VOLVULUS OF SMALL INTESTINE.

Beatrice T., age 13 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 22, 1907, with a history of an attack of acute appendicitis of one week's duration. On admission she presented a peritonitic facies, sweet smell to breath. Fecal vomiting. Has passed mucus, but no blood by rectum. Temperature 98° F.; pulse 128; white blood-cells 12,400. Abdomen is very much distended, tympanitic everywhere except in right iliac fossa and right flank, where note is dull;

no change in level of dulness on change of position of patient. Too much distention to feel any mass. Not rigid, not very tender. By rectum finger feels hard and very tender mass in Douglas's pouch. Lungs negative; slight systolic murmur at apex of heart.

Operation, 3.40 P.M. (one week after onset of illness). Etherized while abdomen was being prepared. Percussion of hypogastric region now gave *succussion splash*, i.e., fluid in air-containing cavity. Incision through right rectus close to median line: omentum presented, adherent to mass of intestine; omentum was full of distended veins, dark yellow and dull. Gauze packs placed. Appendix when delivered was found gangrenous and perforated about one inch from base. Stump ligated, divided, and carbolized, but not buried in cæcum. Glass tube to pelvis gave about one ounce of bloody seropus. Felt many obstructing bands, and found gangrenous small intestine; delivered this, and found a clockwise volvulus of ileum, which was untwisted by giving it one and a half turns in a counter-clockwise direction. This was the gut that was full of fluid and air and that gave succussion splash; it occupied the pelvis, and was the tender mass felt by rectum. The small intestine which occupied the right flank, outside of ascending colon, was also dark blue, distended, and sloughing in spots. Eversion of affected small intestine, with constant hot saline irrigation; this resulted in some improvement in color of highest loops of ileum. Next found collapsed bowel, and traced it up to lower end of distended portion, clamped and divided it, and resected four and a half feet of gangrenous ileum. To relieve distention above region resected, a glass tube was passed up lumen of bowel, as recommended by Monks, emptying upper coils of jejunum of gas and feces, and thus rendering easier their return to abdomen. Then sutured the divided ends of gut to each other and end on into the wound, making a false anus *en canon de fusil*. Time, 1 hour and 15 minutes.

Patient died about half an hour after return to bed.

IV. APPENDICITIS FOLLOWED BY VOLVULUS OF SMALL INTESTINE.

Frank G., age 16 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 7, 1909, with a history of acute attack of appendicitis of over two days' duration. On

admission his temperature was 100° F.; pulse 110; white blood-cells 11,600, with 77 per cent. polynuclears. Abdomen showed small mass close to anterior superior spine of ileum, the rest of abdomen being soft.

Operation at noon (56 hours after onset of attack). Transverse incision of G. G. Davis, three inches long, opening healthy peritoneum on median side of mass. Gauze pads introduced. Light adhesions around cæcum, and gangrenous appendix lying posterior to cæcum; no actual pus. Appendix gangrenous, and had a small perforation on its mesenteric border. Meso-appendix ligated with chromic catgut and divided. In attempting to deliver appendix, it pulled off cæcum, owing to gangrenous state. Stump of appendix at once clamped (no extravasation of feces), ligated, and buried in cæcum; one bleeding point near ileocæcal valve controlled by separate suture. Cæcum had flakes of lymph on it. Glass tube was passed to pelvis, and a few drachms of thin pus were withdrawn. Culture of pus reported "numerous bacteria, mixed." Drains: glass tube to pelvis, one strip of gauze to stump of appendix, and one to hold small intestine away from incision, inner half of which was closed. Time of operation, 30 minutes.

Patient kept sitting up in bed, and given continuous proctoclysis.

December 8: temperature normal; pulse 100. Given some water early this A.M.; vomited at 8 A.M., after some abdominal pain. Abdomen a little distended in epigastrium. Two ounces of pus from glass tube.

December 9: vomited again. Occasional sharp pains. Rubber tube inserted in place of glass. Epigastrium more distended; no flatus by rectum. Temperature normal; pulse 96-110. Two enemas in evening gave fair bowel motion, very little flatus. *No peristalsis can be heard*. Diagnosis: paralytic ileus. Ordered eserine, grain one-sixtieth, at 3 and at 6 P.M. Gastric lavage relieved distention.

December 10: vomited again, bile only. Examined by Dr. Neilson, who concurred in diagnosis of paralytic ileus, and who advised salts in lavage fluid. No flatus was passed. Soon after this examination, peristalsis could be heard, and just after giving next lavage patient vomited some upper intestinal contents. Examined by Dr. Deaver, who diagnosed mechanical obstruc-

tion and advised operation. White blood-cells 29,600, with 86 per cent. polynuclears.

Second operation, 5.30 P.M. (53 hours after first operation). Ether. Reopened transverse incision; pus between skin and sheath of rectus, edges of drained portion of wound were green; all parietal peritoneum of iliac fossa was gray-green; tube draining pelvis well. Lower ileum collapsed. No cause for obstruction found here. Median incision, from left of umbilicus to pubes; no diffuse peritonitis; upper and left abdomen full of distended coils of small intestine; nothing else seen. Delivered six to eight feet of distended gut, and could then see collapsed ileum; picked it up, determined its direction, and traced it upward. Found that loops of distended gut had twisted around this collapsed gut in a contra-clockwise volvulus. Reduced this volvulus by one full turn in clockwise direction. Tracing collapsed gut higher, found three distinct kinks in loops of ileum lying in pelvis, the adjacent limbs held tightly together, and entirely occluding lumen. Almost gangrenous in spots. Kinks separated, and rent in mesentery sutured. Constant hot irrigation over eventrated bowel. Iodoform gauze wick placed over sloughing area; intestines replaced in abdomen; large rubber tube to drain pelvis; wound closed with through-and-through sutures. Time of operation, 45 minutes.

During operation received one pint and a half of saline solution intravenously; was very badly shocked. Stomach washed out again at end of operation. Returned to bed in exceedingly restless condition, and died 26 hours later, on the fifth day after first operation.

Dr. Ashhurst added that cases such as these represent a fair proportion of the emergency work of a large hospital. Although only one of the patients recovered, a discussion of certain of the features of the fatal cases might prove of interest.

Cases of appendicitis may be grouped for clinical purposes thus: 1. Uncomplicated appendicitis, either acute or in the interval. 2. Appendicitis with abscess. 3. Gangrenous appendicitis. 4. Appendicitis with diffuse peritonitis (no adhesions). 5. Appendicitis with multiple abscesses (numerous adhesions). 6. Appendicitis with intestinal obstruction.

Almost invariably a patient when first seen will fall quite unmistakably into one or other of these groups. The first group

is the least serious, and the mortality is less than 1 per cent. The other groups represent cases progressively worse, and the mortality under any kind of treatment rises by leaps and bounds. These groups are not mentioned in pathological sequence, but in the order of their clinical gravity. Many cases of appendicular abscess have passed through the stage of diffuse peritonitis, operation having been delayed purposely or through ignorance. But not all cases of diffuse peritonitis are converted into the less serious class of appendicitis with abscess; a large proportion of them pass over into the form of peritonitis with multiple abscesses, and from this, or without passing through the intermediate fifth group, they become complicated by intestinal obstruction. It is on account of this uncertainty as to the course which cases of diffuse peritonitis are going to pursue, that Dr. Ashhurst does not favor the treatment advocated by Ochsner, of treating all such patients by gastro-intestinal rest and postponing operation until an abscess forms; because in a number of cases no localized collection of pus will occur at any time, but either multiple abscesses will develop or intestinal obstruction will occur, or the patient will die of septicæmia or a terminal infection before relief is afforded by operation.

The first case reported belongs to the fifth group, that of appendicitis with multiple abscesses, the patient having had, in addition to the subphrenic abscess, pus widely diffused in her abdomen, including the pelvis, both flanks, and the region beneath the transverse colon, as shown at autopsy. The second case, with volvulus which occurred before operation was undertaken, belongs to the sixth group. Both these patients could almost certainly have been saved if operation had been possible at an earlier stage of the disease. It is very much more usual for subphrenic abscess or intestinal obstruction to arise some time after an operation than for operation to be postponed until they are present; and when occurring after operation the prognosis usually is much better.

Probably the most complete statistics of subphrenic abscess are those of Lance (*Gaz. d. Hôp.*, 1909, lxxxii, 63, 99), who collected almost a thousand cases, analysis of which confirms the figures published by others, showing that about 20 per cent. are caused by appendicitis; 30 per cent. are caused by lesions of stomach and duodenum; 13 per cent. are caused by

lesions of liver and gall-bladder; 37 per cent. are caused by lesions of pancreas, spleen, large intestine, pleura, etc.

In regard to subphrenic abscess caused by appendicitis, Lance estimates that it occurs in 0.5 per cent. of cases of appendicitis of all kinds, and in 3 per cent. of cases of suppurative appendicitis. In about two-thirds of the cases it occurred some time after operation, usually in cases of appendicitis with localized abscess. He found only 10 cases recorded in which the subphrenic abscess was a primary development in connection with general peritonitis (as in the first case recorded herewith); and in most of these cases no operation was done, the condition being discovered only at autopsy. Lance found that empyema exists in about 60 per cent. of post-appendicular cases of right-sided subphrenic abscess.

Nearly all cases of subphrenic abscess which follow appendicitis are right-sided. Among 106 cases studied by Eisendrath (*Jour. Amer. Med. Assoc.*, 1908, i, 751), only six were left-sided abscesses; and in the large majority of cases the infection spreads by continuity, invading first the right renal pouch, then the right posterior intraperitoneal subphrenic space, including the subhepatic space, and finally reaching the right anterior subphrenic space around the free margin of the right lateral ligament of the liver.

As pointed out in Barnard's admirable lectures (*Brit. Med. Jour.*, 1908, i, 371, 429), the diagnosis is based on the *history of the case, the character of the onset, the signs of pus in general, abdominal signs and symptoms, thoracic signs and symptoms, localizing signs*, and, as a last resort, *aspiration*. In the first case reported it does not seem likely that a more accurate diagnosis was possible than was made: there was undoubtedly diffuse peritonitis, and with a history of indigestion, and most marked symptoms pointing to the upper right quadrant, the gall-bladder or upper digestive tract appeared more likely to be the cause of the trouble than the appendix. In the second case, however, not only was there the previous history of an operation for appendicitis with diffuse peritonitis, but there were very positive localizing signs (bulging, tenderness), which rendered diagnosis easy.

The treatment naturally consists in the evacuation of the abscess; and the incision may be anterior, posterior, or lateral.

Lateral incisions are seldom advisable, being suitable only where the abscess is manifestly pointing in the axillary line. Anterior or abdominal incisions are employed in cases of exploration, where the diagnosis is uncertain, and are to be preferred in all cases complicated by diffuse peritonitis, as in the first case recorded herewith. It usually is advisable to make a counter-incision in the loin, for drainage. In the great majority of cases of subphrenic abscess, however, which conform rather to the type of Case II, where the abscess is of slow formation, and where a positive diagnosis is made before operation, the posterior transpleural or subpleural route is preferable.

Volvulus appears to be more frequent in the small than in the large intestine, contrary to the classical teaching; at least in his own experience, which includes four cases of volvulus (two in connection with a Meckel's diverticulum, and the two just reported), there has not been one case in which the colon was affected. At the March meeting of the Academy, Dr. Hodge (*ANNALS OF SURGERY*, 1910, ii, 271) presented statistics as to the frequency of volvulus, reporting 1 case of volvulus among 61 cases of intestinal obstruction at the Presbyterian Hospital during the last decade, and 7 cases among 57 operations for intestinal obstruction at the Pennsylvania Hospital. Dr. Ashhurst's own experience with intestinal obstruction (apart from strangulated hernias and congenital deformities) embraces only 10 operations, yet 4 of these were caused by volvulus (Case IV, recorded herewith, also presented kinks).

Volvulus seems to be a rare complication of appendicitis, especially when arising before operation. Le Conte reported (*ANNALS OF SURG.*, 1905, i, 148) a case of volvulus of the small intestine occurring two months after appendectomy, which he successfully treated by operation four days after the first symptoms, which commenced mildly; but as there was no mesenteric thrombosis in the affected bowel, he thought the volvulus could not have arisen more than a few hours before operation. When the bowel is gangrenous, as in Case III of the present series, there is nothing to do but resect it; and if the portion removed is high in the intestinal tract, and the patient's condition warrants it, an end-to-end anastomosis should be done; but in cases, as in the present instance, where it is necessary to terminate the operation rapidly, it is better to establish a false anus.

In Case IV, an earlier diagnosis might have enabled the patient's life to be saved. But the differential diagnosis between mechanical and paralytic ileus, while easy in theory, is not always so in practice; and in the absence of projectile vomiting, with no evidence of peristalsis, and with a minimal amount of pain, the existence of mechanical obstruction was not determined until the third day after operation, when pain, peristalsis, and projectile vomiting became noticeable features of the case. Yet on opening the abdomen it was clear that obstruction must have been complete for 24 hours at least.

The *technic of the operation for intestinal obstruction* is one of the least regular and typical known to surgery, and this is perhaps one reason why so few patients are saved by it. It is an accepted fact that it is undesirable to eventrate the distended bowels, and that the collapsed bowel should be sought and traced upward. To find the collapsed bowel it is recommended first to locate the cæcum or transverse colon; if these are distended, the obstruction must be still lower. But in a great many cases, as in Case IV, the distention of the bowels is so great that it is perfectly impossible to see anything else, or even to introduce the hand for search, until the distended coils are removed from the abdomen. But as soon as they are relieved from the pressure of the abdominal wall they become still more distended, and the difficulty of their replacement momentarily increases. Moreover, if we are to believe the physiological researches of Henderson, the acapnia induced by means of these distended bowels greatly increases the shock. In Case III, the use of a glass tube passed up the lumen of the bowel toward the duodenum, as recommended by Monks, quickly relieved the distention and considerably facilitated the return of the intestinal coils to the abdomen. It was not found possible, however, to crowd more than about two feet of intestine upon the tube at one time; but this was sufficient for the purpose in this case. It has been suggested by C. A. Morton (*Brit. Med. Jour.*, March 13, 1909) that the coils of small intestine are not paralyzed by distention so easily as they are thought to be; he holds that kinking prevents the various loops from emptying themselves into one another, and contends that if kinks were absent a single opening in the small gut would be as efficient in emptying it throughout its entire extent as is a single opening in the colon in relieving

distention of the entire large bowel. But the difficulty of overcoming the kinks remains, and several attempts with Monks's glass tube method have not enabled the speaker to overcome the difficulty entirely; the most that it has done has been to promote euthanasia.

Finally Dr. Ashhurst said he should like to secure an expression of opinion from the Fellows of the Academy as to the value of eserin in paralytic ileus. There has sometimes been a suspicion in his mind that its employment has produced mechanical obstruction, by rousing violent peristalsis; and he paraphrased a saying of his father's, that the patient is not sick because his abdomen is distended, but his abdomen is distended because he is sick.

DR. JOHN H. GIBBON, in regard to Dr. Ashhurst's question relative to the use of eserin, said that if there is a mechanical obstruction in the bowel it will do harm, because it is like giving a laxative or purgative to stimulate peristalsis in a strangulated hernia. If one could only say which cases were and which were not mechanically obstructed one could better gauge the use of eserin. Personally, he thought that most of the obstructions after operation are due to some mechanical cause, and in them, therefore, eserin, or anything of a like nature, is apt to do more harm than good.

DR. JOHN H. JOYSON said that he reported last spring before the Academy three cases of subphrenic abscess following appendicitis out of seven or eight subphrenic infections which he had had in his own practice.

With regard to the case reported in which the subphrenic infection was present at the time of operation, he thought it a very unusual one, in that the case was operated upon when the infection had reached the abscess stage. In these cases which are now subjected to the Murphy treatment, it would seem that subphrenic abscess occurs more frequently than formerly, although he did not mean to say that this was due to the Murphy-Fowler position. Formerly they died of peritonitis before it had time to develop. These abscesses are oftentimes overlooked and cases dying with high temperatures and with collections of pus under the diaphragm are often looked upon as cases of peritonitis elsewhere.

With regard to the location of the appendix in these cases,

in two of his cases it was retrocæcal and very high, and in one of these cases he made a counter-opening in the back in order to avoid a subphrenic infection, but unsuccessfully.

As a point in diagnosis, the presence of symptoms of pulmonary infection, subcrepitant râles, and diaphragmatic pleurisy is of great value in making the diagnosis in the early stage. The presence of râles as a frequent symptom was doubted by Barnard in his classical paper, but it is an important diagnostic symptom.

DR. GEORGE P. MULLER, with regard to the use of eserine in intestinal ileus, remarked that he had had brilliant results in a few cases with it. These were, of course, cases of adynamic ileus, generally due to extensive handling of the intestines, especially in placing gauze pads for pelvic operations. He usually tried eserine in any case of intestinal obstruction where he was not sure that it was mechanical in origin. He uses large doses and gives in addition the alum enema as recommended by Dr. Murphy. He did not wish to be understood as advocating delay in the surgical treatment of cases of intestinal obstruction, but wished to state that his experience with eserine in suspected cases of paralytic ileus had been on the whole extremely satisfactory. The advantage of giving eserine at hourly intervals for three or four doses lies in the fact that, unlike medicinal purgatives, it does not increase the fluid content of the intestines but acts by stimulating the muscle of the bowel.

DR. MORRIS BOOTH MILLER said, with regard to the use of eserine, that he agreed with Dr. Gibbon that disappointment often attends its use. He had, however, used it routinely for several years in every case where he feared post-operative ileus. He employed it as a precautionary measure, and so far had been so fortunate as not to have this post-operative complication occur. He used it, alternating it with strychnia, and thereby getting more powerful stimulation to the involuntary muscle of the intestine. With this combination one seems less apt to get the poisonous effect of the eserine.

DR. ROBERT G. LECONTE said, with regard to the use of eserine, he agreed with Dr. Muller. He used it frequently in cases that develop distention after abdominal operation, with the belief that if it does no good it at least can do no harm, and it may perhaps permit of a diagnosis of obstruction due

to mechanical causes to be made sooner than without its use. If it is not effective, it will make the vomiting more obstinate, which may lead to operation the sooner. As Dr. Muller says, it does not increase the contents of the intestines and in that it has marked advantages over the purgatives.

DR. ASTLEY P. C. ASHHURST, in closing, said he was not partial to the use of eserine. In the case reported it had seemed to rouse so much peristalsis as to cause obstruction. In another case, after operation for typhoid perforation, the abdomen was immensely distended, eserine was given; the man had another perforation, and died.

STATED MEETING, HELD NOVEMBER 7, 1910

The President, DR. ROBERT G. LeCONTE, in the Chair

THE TECHNIC OF MEDIAN PERINEAL
PROSTATECTOMY.

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OF NEW YORK,

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EVER since 1887, when the late Mr. McGill, of Leeds, demonstrated the possibility of enucleating the enlarged prostate from its fibrous sheath through a suprapubic cystotomy, the thought and ingenuity of many surgeons have been directed to perfect this procedure, either by modifications and improvements upon McGill's method, or by surgically approaching the prostate by incisions through the perineum.

At the present time there are three well-recognized operative procedures for the removal of the obstruction caused by the enlarged prostate. These are, first, by suprapubic cystotomy and intracapsular enucleation; second, by median perineal urethrectomy and intracapsular enucleation; third, by a perineal incision, which exposes the posterior surface of the prostate and transcapsular enucleation. Each of these methods has its advocates. All of these methods have been modified and improved from time to time.

The controversies concerning operations upon the prostate which have arisen during recent years have been marked often with an undue personal animus which is to be regretted. These controversies have usually been upon minor points of technic and upon questions of priority, and too often the essential question, namely, the anatomical and surgical basis of the operations, has been overlooked or ignored. All of

these operations are frequently performed successfully, but it would be an error to claim that any one of them is a perfect operation which can be performed by every surgeon with uniform success. The last word upon the technic of prostatectomy certainly has not been spoken, nor will it be until there is a more wide-spread and a better practical knowledge of the various pathological and anatomical changes which occur as the result of prostatic enlargement. There are, however, certain anatomical facts which can be clearly demonstrated, and these form the basis of any operation which has for its object the enucleation of the portions of the enlarged prostate which cause obstruction to urination, whether the operation be performed through a suprapubic cystotomy or by either of the perineal procedures.

In the present paper I shall call attention to what I regard as the most important of these anatomical facts, and I shall endeavor to point out their practical significance to the surgeon who performs this operation.

I. WHAT PORTIONS OF THE PROSTATE CAUSE OBSTRUCTION TO URINATION.

It may be positively stated that the portions of the prostate which cause obstruction to urination by their enlargement, whether this obstruction be mechanical or physiological, are those portions which lie upon the sides of the urethra and anterior to the seminal ducts. These are (1) the lateral lobes, and (2) the middle isthmus or middle lobe (when this latter exists). The portion of the prostate which lies behind the urethra and posterior to the seminal ducts does not cause obstruction. This portion I shall call (although perhaps not properly) the posterior isthmus of the lateral lobes.

The Line of Cleavage.—These two portions of the prostate, namely, the lateral lobes and the posterior isthmus of the lateral lobes, are separated from each other by a distinct line of cleavage. This line of cleavage is formed by a series of fibrous bands which radiate outward from a central nucleus,

behind the urethra, and these bands pass outward and forward to join the sheath of the prostate. The shape and direction of this line of cleavage give to the posterior isthmus of the lateral lobes a more or less crescentic shape, with the concavity directed forward. This posterior isthmus of the lateral lobes must become enlarged, but it never causes obstruction to urination. It is not necessary to remove it by prostatectomy, and it cannot be enucleated from the prostatic sheath. It is therefore an error, and not in accord with the facts of anatomy, to say that the entire prostate is removed by any of these prostatectomy operations.

The lateral lobes of the prostate which lie on either side of the urethra, and which, by their enlargement, cause obstruction to urination, are anterior to this line of cleavage. These lobes can be easily enucleated from the sheath of the prostate if the line of cleavage be followed. These lateral lobes in the prostate are loosely attached to the sheath of the prostate. The line of cleavage has a constant anatomical position; the relation of the line of cleavage to the urethra is always the same. This can be shown by a transverse section made through the enlarged prostate at right angles to the urethra. The line of cleavage always begins *posteriorly*, on the level with the floor of the urethra, and extends outward and forward so as to partially surround each of the lateral lobes. If, therefore, the urethral mucous membrane be torn through by the finger at the level of the floor of the prostatic urethra, the line of cleavage will be opened and the lateral lobes can be easily separated from the sheath of the prostate.

II. THE RELATION OF THE BASE OF THE PROSTATE TO THE BLADDER.

Normally, the muscular fibres of the bladder are attached to the upper part or base of the lateral lobes of the prostate. The base of these lobes is not enveloped by the fibrous sheath of the prostate. It is covered by the mucous coat of the bladder. This coat is rather loosely attached and may be easily pushed off from the base of the prostate by digital dissection.

The Anatomical Middle Lobe.—The lateral lobes of the prostate are joined together by a wedge-shaped band of prostatic tissue, which varies in quantity in different individuals, and which runs behind the urethra and in front of the seminal ducts. This is known as the anatomical middle isthmus or middle lobe. When this band becomes enlarged, it arrests the finger during the enucleation of the lateral lobes from within the sheath. This middle isthmus, however, can be broken through at its junction with either lateral lobe by the finger. When the prostate is separated from its sheath by following the line of cleavage and the middle isthmus is broken at its junction with either lateral lobe, the latter is suspended within the sheath of the prostate only by the attachment of the mucous membrane of the urethra. This mucous membrane is easily torn through by the finger, and the enucleated lateral lobe then lies free within the prostatic sheath and may be extracted through the external wound by forceps. The enucleation of the lateral lobes is comparatively easy if the facts just mentioned are known and their practical value appreciated.

The enucleation of the middle lobe or middle isthmus, when this is enlarged and causes obstruction, is a little more difficult. The presence of a so-called middle lobe is not a constant factor in prostatic enlargement, and when there is present a so-called middle lobe enlargement, the condition is not always the same either morphologically or anatomically. I think it necessary, therefore, to call attention to certain anatomical facts, the importance of which does not seem to be appreciated by some writers upon this subject.

Some years ago I called attention to the fact that the so-called middle lobe enlargement which projects in some cases intravesically between the two lateral lobes is not always anatomically the same; it may be due either, first, to enlargement of accessory glands, which are situated in some cases just beneath the mucous membrane on the posterior side of the internal urethral orifice; or second, it may be due to enlargement of these glands, plus an enlargement of the

anatomical median isthmus; or third, it may be due to enlargement of the anatomical median isthmus alone. The importance of the enlargement of these accessory glands in this situation is that they push upward the muscular fibres beneath the trigone and thus interfere with the opening of the urethra at the time of urination. The real anatomical isthmus, when this is enlarged alone, can be removed or enucleated with the lateral lobe, which is last removed, by passing the finger beneath it and by stripping it off from its connection with the mucous membrane of the bladder. The enlargement of the accessory glands alone cannot be enucleated without tearing the mucous membrane on the posterior lip of the vesical outlet.

Since 1895, in nearly all cases, I have been doing a median perineal operation, which I shall now describe.

Preparation of the Patient for Operation.—As a rule, no special preparation is necessary. I think it is inadvisable to change in any important particular the habits of an old man, and therefore, unless there is some evidence of kidney insufficiency, I operate without any previous preparation, except that it is customary to give the day before operation a dose of castor-oil, and to follow this with a simple enema. It is best when possible to operate early in the morning, so as to insure for the patient a good night following the day of operation. The operative field of the perineum is prepared by shaving the surface and by washing with green soap and water. No antiseptic is used. The perineum is then covered with dry gauze and a towel. In anæsthetizing, nitrous oxide gas, followed by ether, is employed. The patient is put in a position of lateral lithotomy, the buttocks overhanging the edge of the table. It is not desirable to make this position extreme by over-flexion of the thighs upon the abdomen. The operating table should be high, so that the perineum will be on a level with the chin of the operator as he sits at the foot of the table. A lithotomy staff with a deep median groove is passed into the bladder. This is then given to an assistant who stands on the patient's left and who holds the staff steadily on the

median line. The perineum is divided in the middle line by an incision of about two inches in length, which terminates behind at a point about three-quarters of an inch in front of the anterior margin of the anus. The skin, the superficial fascia, and Colles's fascia are divided. Buck's fascia covering the accelerator urinæ muscle is not divided. The membranous urethra is divided by thrusting a sharp-pointed straight bistoury into the groove of the staff just behind the bulb of the urethra, and cutting forward the floor of the urethra and the lower border of the triangular ligament; a grooved director is then passed in until its point enters the groove of the staff. It is then gently pushed forward through the prostatic urethra and into the bladder, and the staff is withdrawn. The groove of the director is turned backward, and along this the bistoury is guided with the cutting edge directed backward, and the membranous urethra thoroughly divided up to the apex of the prostate. It is of the utmost importance that this division of the floor of the membranous urethra should be thoroughly done, and for this purpose a very sharp knife should be used so as not to lacerate the compressor urethræ muscle. The operator, holding the director in his left hand, introduces the forefinger of his right hand into the wound, and, keeping close to the groove of the director, pushes the finger forward until its tip has passed into the prostatic urethra. The director is then withdrawn, and the finger is advanced with a slight rotary motion through the prostatic urethra, thus dilating this portion of the canal. There is usually very little bleeding up to this point. In cases in which the prostate is not greatly enlarged, the finger can be passed through the prostatic urethra so that its tip will enter the bladder. In cases of marked lateral enlargement, it is sometimes impossible to force the finger entirely through the prostatic urethra.

The second step in the operation, namely, enucleation of the lateral lobes, is now begun. In order to proceed in a systematic manner, I always remove the obstruction from the side which is the larger, but when the two lateral lobes are

of about equal size, I remove the right side first. The forefinger of the right hand is turned with the nail towards the floor of the urethra. The mucous membrane on the side of the urethra is torn through with the tip of the finger at a level with the urethra floor, and the line of cleavage is entered. As soon as the mucous membrane is torn, the finger, following the line of cleavage between the enlarged lateral lobe and the portion of the prostate lying behind it and the sheath, separates the one from the other by a sweeping movement outwards and forward. At the same time the tip of the finger is pushed upward toward the bladder wall. The pulp of the finger should be turned towards the prostatic capsule, and the nail should be kept closely to the outer side of the lateral lobe which is being enucleated. The finger should not pass beyond the middle line either in front of or behind the urethra, for it is perfectly easy to separate one lateral lobe from the other. When the side and posterior surface of one lobe have been freed from within the sheath, the base of the lobe which is attached to the bladder wall can be separated from the latter by hooking the finger above its upper margin, and by a sawing motion this can be easily peeled from the bladder wall without injury to the mucous membrane of the latter. When this has been done, the junction of the lateral lobe with the middle isthmus is torn through by the finger. The mucous membrane along the upper surface of the lobe is now torn through, and the enucleated mass can be picked out from within the capsule by a small pair of lithotomy forceps. These should be tightly closed in delivering the enucleated mass, so as not to unduly stretch the opening which has been made in the floor of the membranous urethra.

The same procedure is now followed on the opposite side, and in a case in which there is only lateral lobe enlargement, this completes the enucleation. In cases in which there is very marked enlargement of the lateral lobes, so that the tip of the finger cannot be passed through the prostatic urethra and into the vesical orifice, the enucleation may be begun in the

manner above described, and the lateral lobe separated from the prostatic sheath; but it may be necessary, in order to separate the lobe from its attachment to the bladder, to seize the lobe with forceps and draw it towards the perineum and over towards the opposite side. The forceps are held with one hand, and a gentle traction is made; the forefinger of the other hand is passed between the mass to be removed and the capsule of the prostate, and is hooked over the upper margin of the lateral lobe, which is then to be stripped off from the mucous membrane of the bladder.

When the lateral lobes have been removed and the line of cleavage closely followed, little injury will have been done to the prostatic plexus of veins which run through the sheath of the prostate, and therefore the bleeding will be inconsiderable. After the right lobe has been removed, it will be found that in separating the left lobe the working space within the capsule is increased and the enucleation of the second lobe is much easier. In cases in which there is obstruction on the floor of the urethra at the vesical orifice (so-called middle lobe enlargement), this is to be removed after the lateral lobes have been enucleated. In most cases the middle lobe can be enucleated with one of the lateral lobes, preferably that which is taken out last. This is done by simply separating it with the finger from beneath the lower lip of the urethral orifice. When this cannot be done, the middle lobe can be seized just beneath the mucous membrane of the bladder by forceps passed along the finger and separated from it.

The middle lobe, when enlarged, is sometimes quite difficult to remove because of its firm attachment to the bladder. If, however, the forefinger of the right hand be passed up into the space which was occupied by the left lobe, there is not much difficulty in pushing the middle lobe over to the right side and separating it from the bladder and the urethral mucous membrane. To facilitate this it may be caught with forceps and pulled down toward the perineum. In some cases the middle lobe consists simply of a soft tab of raised mucous

membrane with the enlarged accessory glands. These cannot be enucleated without tearing the mucous membrane, and in such a case I usually catch the tab with forceps, draw it down towards the perineum and cut it off cleanly with scissors in the same way in which the uvula is shortened. I have done this a number of times; the part cut off consists only of dilated glands and mucous membrane, and the cutting does not destroy the muscular fibres of the bladder.

At the completion of the operation of enucleation, the vesical outlet is felt as a soft ring which fits loosely the end of the forefinger. The floor of the bladder is level with the urethra. The mucous membrane about the vesical orifice is intact on all sides, and in case of enlargement limited to the lateral lobes, the mucous membrane upon the floor of the urethra, including the verumontanum, may be and usually is preserved. The cavities from which the lateral lobes have been removed are quite smooth. The position and shape of the prostatic urethra are preserved in a very remarkable degree by the contraction of the prostatic sheath and by the action of the levator ani muscles.

Changes in method are required in certain cases. When the prostatic lateral tumors are very large and consist of irregularly shaped masses each of which seems to be surrounded by its own capsule, it may be advisable to remove the lateral tumors from each side in two or three parts and not *en masse*, so as not to over-stretch the urethra or lacerate the compressor urethræ muscle. The line of cleavage between the tumors can be felt and they can be separated from each other and from the mucous membrane or bladder wall, and removed separately.

When it is necessary to do this some part of the lateral lobe may be overlooked and not removed. This is especially likely to occur about the vesical orifice. It should therefore be a rule that the operation is not considered complete until the mucous surface of the latter is felt to be smooth and even, the tissues pliable, and the orifice dilatable and its floor level with that of the bladder.

In cases of long-standing prostatic disease in which the fibrous changes are marked in both the prostate and bladder wall, the enucleation of the obstructive masses is more difficult because of the firm attachment of these to the capsule and bladder wall by strong bands of fibrous tissue, which are difficult to break with the finger, and it is sometimes necessary to catch the obstructing mass with forceps and to divide the bands with scissors passed into the wound under the guidance of the finger.

The Control of Hemorrhage.—The operation of enucleation of the obstructing portions of the prostate being completed, the control of hemorrhage demands attention. I have found that when the neck of the bladder is drawn down toward the perineum after removal of the obstruction, the veins of the prostatic plexus are compressed and the hemorrhage ceases immediately. I therefore have adopted the following method to accomplish this: The tip of the forefinger of the left hand is introduced through the wound into the bladder, and is hooked over the lower lip of the vesical orifice. Along this finger is passed a pair of flat volsellum forceps, and with these the lower lip of the vesical orifice is grasped; the forefinger is withdrawn and slight traction made upon the forceps. The hemorrhage at once stops.

Bladder Drainage.—A metal tube is then introduced into the bladder and the bladder irrigated with hot water to remove all clots. The metal tube is removed and a large rubber catheter, No. 32 F, is passed into the bladder in front of the forceps. This should be accurately placed so that the eye of the catheter is just within the urethral orifice. Adequate drainage of the bladder depends upon the proper adjustment of this tube.

Wound Dressing.—An assistant holds this tube in place, while the surgeon packs with gauze the cavities left by enucleation of the lateral lobes. This packing should be made of iodoform gauze one inch wide. This is passed by long forceps alongside of the tube, and during its introduction gentle traction is made upon the forceps which hold the vesical outlet.

The ends of the gauze packing hang out of the wound. After the packing is in place the drainage tube is tested, and is then secured by pinning it to the skin with a safety pin. The dressing is then applied. This consists of a pad of gauze which is slipped between the skin and the safety pin,—two or three pads of folded gauze on either side of the tube and two pads of cotton and gauze. These are to be held in place by a special 3-tailed T bandage. During the dressing the surgeon makes gentle traction upon the forceps to prevent the bladder from slipping upwards and causing bleeding. The tube is then tested again and the patient put to bed. The forceps holding the bladder are then removed, and a simple siphon tube is attached to the bladder tube by a glass connection. The siphonage tube should be passed under the patient's knee and the free end dropped into a large bottle placed at the bedside, containing six or eight ounces of a 1:5000 bichloride solution. The siphon is secured by a pin to the draw sheet of the edge of the bed. When siphonage has been established the glass tube will be full of fluid, but if the drainage stops the tube will be empty. The tube may be full and yet drainage may be defective if a clot of blood plugs up the eye; when this occurs there will be leakage along the tube and soiling of the perineal dressing, and there will be associated with this pain at the end of the penis and a painful desire to pass water. The efficiency of the drainage and the comfort of the patient after operation depend upon the care with which the drainage tube is placed and secured. If the siphonage tube is too long it causes pain by sucking the bladder wall into the eye of the tube. When the drainage tube is properly adjusted and secured and the dressing evenly and artfully applied, the patient has no pain and rarely needs an anodyne. With this mode of dressing and drainage the patient may lie upon his back or upon his side (the side opposite to that on which the siphonage bottle and tube are placed), but the position of these may be changed from time to time to suit the wishes of the patient and to permit of his freer movements.

The Post-operative Management.—The management of

cases after prostatectomy is of as much importance to secure a successful result as the operation. A skilfully performed operation may fail by unskilful nursing or failure to attend to the necessary details, but I now expect to have prostatectomy operations follow much the same course as simple perineal sections.

General Treatment.—For the first two or three days I give a light diet of eggs, cereals, milk, broth, tea, toast, and as much water as the patient can be made to take. If the drainage is perfect there will be little leakage about the tube, but if the prostate removed has been large there may be some leakage along its sides by the capillary action of the gauze strips, which will necessitate the changing of the outside dressing. If there is no pain and no clogging of the tube by retained clots the tube should be gently washed out once or twice to keep it clear and to remove pus in cases of cystitis. In some cases a pillow placed under the patient's knees will give relief to the backache due to the dorsal position. If the drainage is perfect and the patient comfortable, this is the plan to follow for 24 hours. A cathartic is given at the end of 24 hours. I then make the first change of dressing. The tube is removed and the gauze packing is taken out of the wound and the urethra flushed out with saline solution. After removing the gauze there is sometimes free oozing of blood, but this stops in a few minutes. A little iodoform gauze or gauze soaked in a 2 per cent. protargol solution is placed between the edges of the wound so as to separate them. I then apply over the perineum a cotton gauze dressing in the form of pads secured by the 3-tailed T bandage. These are changed every two to three hours.

After removing the tube there is usually almost complete urinary incontinence for two or three days. This is because the patient cannot control his over-stretched and atonic sphincter. But control is soon gained and he then passes voluntarily at first through the wound. The discharge of urine through the urethra usually begins about a week after operation. The dressing of the perineum should be changed

as often as necessary to keep it dry, and the wound should be washed by a flow of water injected into it from a syringe to wash away any urine; the skin about the anus and wound should be powdered with talcum. The wound is subsequently inspected twice a day and is made to heal from the bottom. The edges of the wound should be wiped with cotton every day to prevent the growth of epithelium into it.

It is not my custom to pass any sound through the urethra for several weeks after operation. The bladder for the first three days is washed out by passing a catheter through the perineal wound. After this time, if it is necessary to wash out the bladder on account of a cystitis, a catheter a coudé can be easily passed through the urethra.

The Control of Urination and the Return of Vesical Power.—It is not to be expected that the patient's control over urination should be immediately and perfectly re-established, when we consider that the operation has disturbed the relation of the sphincters and caused them to become atonic by stretching, but it is surprising how quickly this control returns, although sometimes after the operation the calls to urinate, if not heeded, will be followed by involuntary escape of urine. But as soon as the wound has healed and the tissues which have been cut and disturbed have consolidated, the power of retaining and expelling urine voluntarily is perfect. In most cases now this can be expected in six or eight weeks, but in many this result is obtained much earlier.

The return of vesical function, no matter how atonic may have been the bladder, is to be confidently expected, provided there remain no obstruction to urination and there be no incurable cystitis. As a rule the bladder is free of cystitis by the time the perineal wound is healed. Its expulsive power gradually improves, and there is only to be noted that the capacity may be lessened, owing to the weakening of the muscle at the vesical outlet which permits a little urine to escape into the urethra before the former capacity of the bladder is exceeded. On this account we find that the intervals of urination after operation may be four instead of six

or eight hours, and the patient may have to get up once or twice even during the night. This condition improves with time, but should be understood. The cystitis in any case will get well under washing and local injection, if the bladder is not sacculated and if there is no obstruction to urination.

ADVANTAGES OF THIS OPERATION.

1. It is a clearly defined surgical procedure which has a rational anatomical basis.
2. It can be very rapidly performed by a practised hand, the operation lasting rarely more than five minutes and the patient being not more than 15 or 20 minutes upon the operating table.
3. The hemorrhage can be quickly and effectually stopped.
4. The drainage of the bladder is simple, and need not be maintained after the first 24 hours.
5. The patients are spared the discomforts of continuous drainage and irrigation.
6. The comfort of the patient is much greater than after any other form of prostatectomy.
7. The functional results are very satisfactory.

THE TECHNIC OF SUPRAPUBIC PROSTATECTOMY.

DR. JOHN B. DEEVER, with reference to the technic of suprapubic prostatectomy, said that:

The technic of suprapubic prostatectomy commences in reality with the selection of the patient for operation. A patient, irrespective of age, good general health, good kidneys (in that they functionate normally, that is to say, excrete the normal amount of urine from the stand-point of the patient's age), with a large soft prostate, one that upon palpation with the finger in the rectum gives a sensation as if it were movable in its capsule, is a suitable case for operation.

He laid great stress upon the condition of the kidneys in the selection of his patients, and then preparation for operation. The patient must pass the normal amount of urine for a man at his time of life, considering that he must have more or less contraction of the kidneys, therefore the amount of urine must be larger than he had passed earlier in life. The speaker also

laid stress upon the percentage of urea. He cared little if there is albumin, so long as it is not much, or if there are casts. He also considered carefully the condition of the bladder, its capacity, its tonicity, the amount of residual urine, the degree of cystitis if any, and the presence or not of a stone.

A cystoscopic examination should be made in certain cases, which will determine the condition of the bladder, the vesical aspect of the prostate, ureteral orifices, etc.

A bad cystitis should receive serious attention and is best handled by a retention catheter and bladder washings with boric acid, permanganate of potash, argyrol, etc. Culture of the urine to determine the micro-organism is essentially important. A few cases will not tolerate a permanent catheter, but will not be made worse by passing a catheter twice daily when the bladder can be irrigated. This will enable the operator to determine the class of cases in which he can close the bladder wound and that of the abdominal wall up to the drainage tube and thus prevent infection of the wound, which so often is a disagreeable factor; in this wise convalescence is hastened. A severe cystitis at the time of operation favors epididymitis; so does passing of sounds too soon after operation.

In the presence of high arterial tension as shown by the pulse, which is also often irregular, and the blood-pressure instrument, a course of nitroglycerine, the drinking freely of water, and in some cases proctoclysis are necessary to bring the case to a successful termination after operation.

The surgeon's anxiety and greatest responsibility only commence, as in many surgical operations, after the operation. Proper nursing at the hands of a gentle, kind, diplomatic, and experienced female nurse is important.

The operative technic involves the following elements:

Anæsthetic.—Ether is the only anæsthetic used in the speaker's clinic and he has no reason to think of using any other. Ether has always been perfectly satisfactory if properly given.

The anæsthetic may be given with the patient in the Trendelenburg position. The patient having been anæsthetized, an English catheter is passed into the bladder, followed by the introduction of two ounces of boracic or normal salt solution, catheter clamped with hæmostat.

Incision. Opening of bladder. Retractors. Inspection of bladder. Piece of gauze in the fundus of the bladder. Circular incision round internal meatus over prostate. Enucleation. Hemorrhage. Drainage.

Massage to coapt walls of bed of prostate. Small piece of gauze in perineal space to be removed in two days. Gauze in bed of prostate to control bleeding. Sterile rabbit serum if coagulation time is very slow. Can save prostatic urethra frequently.

Before recovery from anæsthetic, hypodermoclysis followed by proctoclysis.

After-treatment.—Avoid passing instruments through the urethra for three weeks, then simply to see if channel is unobstructed.

Stricture: Irregular margin of roof of bed of the prostate may be the cause of subsequent trouble. Two cases in speaker's experience requiring correction. Suspensory to be worn during convalescence.

After drainage tube is removed, wash out through suprapubic opening until it becomes too small to pass it, then introduction of simply the end of the nozzle of the tube into the external meatus and wash out bladder. This is sometimes required while the suprapubic wound is still large enough to wash out the bladder through this avenue, as when there are pus or shreds in the urine this affords means of thorough cleansing of the base of the bladder. The latter can be done through a soft catheter passed through the urethra into the bladder, but should not be used if avoidable, for fear of disturbing the healing process going on in the prostatic bed. Dr. Deaver said he had seen prevesical abscess, for which it may be necessary to incise the perineum.

DR. EDWARD MARTIN said that Dr. Alexander's work has received such universal acceptance that a discussion of his findings amounts to little more than a congratulatory appreciation. He had completely summarized the principle of enucleation of the prostate in the sentence "find the line of cleavage." That done, the operation is simple. He, however, had to confess a lack of confidence in surely striking that line when guided only by the sense of touch—he preferred to look in by a wider opening than is afforded by the median perineal route. Shock is, how-

ever, proportionate rather to the roughness and long continuance of manipulation than to the size of the wound. In men over fifty also comes the possibility of sexual incapacity being dependent on perineal trauma. The perineal route is more frequently followed by this disability than is the suprapubic. He had seen the same result follow the perineal operation for stone, and, in fact, almost any perineal operation, and believed that this impotence is in no wise due to damage to ducts, but is the result of extensive perineal trauma.

With regard to Dr. Deaver's remarks, it is perfectly true that the Trendelenburg position with proper illumination brings the operative field within the range of vision. He had devised a little light for these operations that goes into the bladder with a lateral retractor, so that until free bleeding occurs the base of the bladder and the urethra and urethral orifices are plainly seen. It is stated that Freyer always enters through the anterior commissure, he believing the line of cleavage to be most marked at this point.

DR. THOMAS R. NELSON said that he was a firm believer in the selection of cases for operation. Some bad results can be prevented by being cautious as to those who are subjected to operation. The condition of the kidney, as well as of the bladder, should as nearly as possible be known, and any needed preliminary treatment given. After operation it is wise to pass sounds. This applies to either form of prostatectomy. It can do no harm, and may do much good.

Drainage of the prevesical space is a detail in the completion of the suprapubic operation which should not be omitted. In every suprapubic operation a small gauze drain should be placed there to prevent infection which might otherwise occur.

DR. HARRY DEEVER said that he had had some difficulty in controlling hemorrhage in these perineal operations, and he thought in suprapubic operations the hemorrhage to be more easily controlled. Cases may go on nicely for four or five days, then may be purged very freely and after that hemorrhage may occur. The bowels should be kept as quiet as possible until the vessels are entirely healed.

DR. SAMUEL ALEXANDER (in closing) said, with regard to the line of cleavage, that this point applies just as much in the suprapubic operation as in the perineal. This line of cleavage

is clearer at the upper commissure than anywhere else, and any surgeon who studies the part of the prostate left as well as the part removed, will have no difficulty in reaching the same conclusion.

He did not claim any priority for any operative procedure, but simply emphasized the anatomical principles which underlie prostatectomy, whether this be done through the suprapubic or through the median perineal route. He agreed with Dr. Deaver that it is a matter of very little moment whether a part of the prostate is left behind or it is all taken out.

With regard to Dr. Deaver's remark that he had made no mention of bacteriology, he supposed was meant whether there exists a septic condition in the bladder or in the kidneys. He made no special preparation of his patient because the operation, as it is done, gives the very best treatment for septic conditions of the bladder that can be secured. If the bladder is opened and drained just as an abscess is opened, the best possible chance is given to recover itself; it does not matter whether the infection is streptococcic, staphylococcic, or gonorrhœal. The lowest possible level of access to the bladder is secured through the technic employed by him. The bladder is drained and then nature takes care of it.

Is it necessary to look into a bladder in order to see a prostatectomy? Many surgeons operate for appendicitis through a very small opening, separating adhesions with great skill, delivering the appendix, and then tying off, and have their patients recover. By practice and study of the prostate any one may become so proficient that he does not do a "blind" operation. He will be able to feel the line of cleavage just as he feels where the adhesions go in a laparotomy, can recognize the condition of the prostate just as that of the appendix, gall-bladder, or any other organ, and it is purely a matter of whether a man will take the pains to train himself as to which operation he will do. Of course, if one does not study the large number of museum specimens which are going to waste, if one will not take the trouble to dissect them intelligently, one will continue to do the open operation, but if one does study them one will learn so much more in regard to the prostate that the line of cleavage will become as simple as the Golden Rule.

In determining where to begin enucleation, cut the lateral

lobe with scissors and feel down for the line of cleavage. The statement that the base of the prostatic tumors is covered by mucous membrane is not in accordance with anatomical facts, as can be shown by any longitudinal section of a prostate.

The advantage of the perineal operation is simply in the general surgical principle that in removing a growth from any place it should be gotten out by the shortest possible route, with the least damage to tissue and least danger of hemorrhage, and in this case the median perineal is the route to follow. The only reason it is not universally adopted is because men have not taken the pains to study the pathological anatomy of the parts.

In regard to the bad results, Dr. Alexander did not feel any fear in reference to stricture as he did the operation. It is not his custom to pass any sound through the urethra until several weeks afterward. He then passed a sound in order to see that the urethra is all right. In this operation the mucous membrane is entirely preserved around and outside the urethral orifice. It is not necessary to preserve the urethra, but to prevent stricture it is necessary to preserve a perfect smooth mucous membrane about the urethra, and that is always the case in a properly performed perineal urethrotomy.

STATED MEETING, HELD DECEMBER 5, 1910

The President, DR. ROBERT G. LE CONTE, in the Chair.

VOLKMANN'S ISCHÆMIC PARALYSIS.

DR. JOHN H. JOPSON presented a boy of eight years, who was brought to him about three weeks after sustaining a fracture of both bones of the forearm, which had been treated by the use of anteroposterior splints. When the splints were removed, about ten days after the accident, pressure sloughs were found on both the flexor and extensor surfaces of the forearm. Contracture of the fingers and hand quickly followed. The contracture was typical of Volkmann's ischæmic paralysis, viz., a fixation of the part due to shortening of the flexor tendons of the fingers. There were unhealed ulcers on the flexor and extensor surfaces. Two months later the boy was admitted to the Presbyterian Hospital.

On examination of the arm, the ulcerations were found to be healed. That on the flexor surface was adherent to the subcutaneous tissues. The hand was held in a position of flexion and pronation, the fingers extended and abducted (Fig. 1). The hand could be moved about 30°. When the fullest extension possible was obtained, the fingers were flexed; when the hand was flexed, they were extended. There was anæsthesia over the distribution of the ulnar nerve in the hand.

Massage and passive motion were used for the next two months without much improvement.

Operation five months after original injury. An incision was made at the site of the scar on the flexor surface of the forearm, four inches long. The tissues beneath were adherent and were separated. The muscles were yellow in color and in a state of degeneration, brittle, and fibroid. Both the median and ulnar nerves were imbedded in fibrous tissue, and adherent, thinned out, and atrophied as if by pressure, for a considerable distance in the lower third of the forearm, but above this point abruptly becoming of normal appearance.

Muscles and nerves were dissected apart, and myotomy and lengthening of the flexor sublimis digitorum and palmaris longus

were practised. The flexor profundus was not lengthened, although contracted, this being deferred for a second operation, if necessary. The forearm and hand were dressed upon a palmar splint.

This operation has been followed by some improvement. There is an increased range of motion; the area of anæsthesia is lessening, and further improvement is hoped for, especially as the condition in which the nerves were found was one which would promise a gradual improvement.

Dr. Jopson added that both the etiology and treatment of this condition have been the subject of considerable discussion, and the valuable paper of John Jenks Thomas, in the *ANNALS OF SURGERY* for March, 1909, contains an excellent review of the subject from these stand-points. The principal theories advanced as to the causation are obstruction to the arterial supply, interference with the return venous circulation, and compression and injury of the nerves.

The latter is looked upon by some writers, including Thomas, as a secondary and contributing but not a necessary factor in its causation. In over one-half of the cases symptoms of nerve involvement were present. Tight bandaging is not always a factor in the etiology. Whatever the cause, the changes in the muscles involved are very striking, both macroscopically and microscopically. They are found to be yellow in color, hard, contracted, the nuclei and transverse striations lost, and the connective-tissue elements increased.

Treatment is oftentimes unsatisfactory. Operative measures include lengthening of the contracted muscles by plastic operations on the tendons or, better still, upon the muscles, freeing of the nerves, and shortening of the bones by resection.

DR. GWILYM G. DAVIS said that he had seen some of these cases. Personally he was inclined to think the nerves play a very considerable part in the deformity produced. In the picture which Dr. Jopson had passed around the position assumed by the hand was almost absolutely that of ulnar paralysis. The extension of the proximal phalanges and the contraction of the distal and middle ones was most typical of that which resulted when the ulnar nerve is injured. It is believed that the injury of the median nerve does not cause so much trouble, because its distribution in the hand, as far as motor influence goes, is com-

FIG. 1.



Volkmann's ischæmic paralysis.

paratively slight, therefore when the two nerves are injured, as was apparently the case in Dr. Jopson's patient, the contraction of the muscles supplied by the ulnar nerve overshadows that of the muscles supplied by the median nerve, and the consequence is the typical contracture of Duchenne. On operation the muscles are found more or less bound together and the tendons to the nerves.

As regards the treatment, the most severe cases are at present almost hopeless, but there are a number of others not of the highest grade of severity for which very much can be done, and the line of treatment is perfectly clear. In the first place, one ought to lay back such a flap as will give proper access, and then follow the ulnar and median nerves down through the cicatrix, if necessary deliberately resecting them and uniting the ends again. As regards the tendons, they should be separated and lengthened in the manner followed by Dr. Jopson. Advantage should be taken of the fatty tissue to slip it in between the tendons, and also the use of Cargile membrane may be resorted to.

The same condition identically is produced by injuries of the forearm, the result of machinery accidents, and the same treatment is applicable.

DR. JAMES K. YOUNG said that something should be said of the manipulation in these cases in addition to the operative methods. After the operation it is advisable to manipulate them after the method of Robert Jones, of Liverpool. He showed in Washington this method, manipulating first the hand, holding the arm firm, and he claimed very good results. In addition to the operative treatment such manipulation of the parts will very much improve the condition.

DR. JOHN H. GIBBON remarked regarding the technic of anastomosis of tendons and nerves, calling attention to a method to prevent the fixation of the nerve in scar tissue. It is known that Cargile membrane and other kinds of material are used to prevent the fixation at the point of anastomosis, but it occurred to him in making an incision to take one of the big superficial veins and make a cuff from it. He therefore resected about an inch and a half from one of the large veins, put it in salt solution until ready for it, then, resecting the nerve, slipped the cuff up on one end, brought the other end of the nerve up and sutured it, then slipped the cuff over the point of anastomosis. Although

the result obtained in this case (one of long standing) was unsatisfactory, he believed the use of the superficial veins in this way would be a satisfactory method of preventing adhesions, which are so apt to occur at the line of anastomosis.

After performing this operation, he learned that some one else had thought of this method, although he had never heard of it.

DR. J. EDWIN SWEET called attention to a method of attaining the result desired by Dr. Gibbon—the use of veins or arteries of animals, stretched over glass rods and hardened in formalin, the formalin removed by washing in water, and the preparation then boiled. This method, suggested by Foramitti, has two advantages over the use of a fresh superficial vein: the one, that different sizes and lengths can be prepared and kept on hand; the other, that the tube thus prepared resists absorption longer than the fresh tissue, and would be less likely to become adherent in either the nerve or the surrounding structures.

FRACTURE OF THE PATELLA.

WITH A REPORT OF FIFTY-SIX CASES.

By EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA,

Demonstrator of Fracture Dressings, Jefferson Medical College and Women's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

THIS paper comprises a study of 56 cases of fracture of the patella, admitted to the Episcopal Hospital since the year 1905.

To Drs. Neilson, Deaver, Davis, and Frazier, to whose services these patients were admitted, I am indebted for the privilege of reporting these cases. To Dr. H. C. Deaver I am especially indebted for the privilege of operating upon several of these cases, and to his wise counsel, especially in suggestions of operative technic and after-treatment, do I owe much of the success gained.

The primary object of this paper is to discuss the operative technic and after-treatment, therefore little shall be said of the causes, varieties, diagnosis, and symptoms of this very important and interesting fracture.

Of the 56 cases tabulated, 37 were in males, while 19 occurred in females, a ratio of almost two to one. There is no anatomical explanation for the more frequent occurrence of this fracture among males, and, in all probability, it is due to their greater exposure and activity.

The ages in this series range from 18, the youngest, to 77, the oldest. I have arbitrarily classified them according to age as follows:

Four occurred between the ages of 10 and 20; 11 between 21 and 30; 19 between 31 and 40; 14 between 41 and 50; 6 between 51 and 60; 1 between 61 and 70, and 1 between 71 and 80.

The greatest frequency occurred between the ages of 31 and 40 years; the period, certainly, of the greatest business

activity. It is rather unusual for this fracture to occur under 20 years of age. This is probably due to the bony condition or better muscular control of the young, they being less apt to slip or fall. The youngest patient that I have any personal knowledge of was a boy aged 12 years. This case was operated upon with excellent result, by Dr. H. C. Deaver, at the Children's Hospital of the Mary J. Drexel Home.

Of the 37 males, 19 broke their left patella, while 18 broke the right. Of the females, 11 broke the left, and 8 the right patella.

It appears from this, although the numbers are almost equal, the ratio being larger in the females, that the left patella is more apt to be fractured. Anatomists claim that no asymmetry exists in the lower extremity. Is this fracture purely an accident or is there some cause for its more frequent occurrence in the left patella? Some greater muscular development, a longer step with one leg, or a firmer tread with one foot should be thought of.

The causes given in this series were: "fell," 27; "slipped," 27; "kicked," 2. The histories were somewhat indefinite on this point and I could find only 9 that actually fell from a distance, so whether the "fell" meant a slip and a fall, or a fall from a distance, I cannot say. I am inclined, however, to think the former the case. Several of the patients stated that they slipped, heard something break, and fell.

A great majority of these fractures were of the usual transverse variety, with the large fragment above. A few of this transverse variety showed the reverse to be true, the large fragment being below. Forty-nine cases were of this combined transverse type. Six cases were comminuted; these occurred in two that were kicked, and in four that fell from a distance. The number of fragments in this latter type varied from three to many. No compound fracture occurred in this series.

I have taken a picture of a normal patella in three positions: with leg extended, semiflexed, and acutely flexed. The patella with the leg semiflexed is seen at the highest point of

the condyle of the femur, and it is with the leg in this position that the fracture usually occurs. A sudden strain on the leg, with a violent contracture of the quadriceps extensor muscle, snaps the patella at its weakest and most unsupported point, the lower third.

The symptoms and diagnosis I shall omit, as there is nothing I can add to that already known of the former, and the latter is usually quite easy.

Little shall be said of the non-operative treatment, as all agree that by this method nothing but fibrous union can be hoped for, with more or less separation of the fragments. Certainly in the great majority of instances the results are far inferior to those of the open method of treatment. There are, of course, certain cases that must be treated by this method, as the aged, those in whom some constitutional condition contraindicates operation, or those, who although good operative risks, refuse to be operated upon. Comminuted fractures, with no separation or tilting of the fragments, and, in all probability, no tear in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, may also be treated by the conservative non-operative method. Of the many conservative methods of treating this fracture, that employed by the late Dr. Agnew is probably as good as any.

I am fully aware that many think the open method of treatment a dangerous one and one that should be done only by a skilled operator. They are willing to operate themselves, but unwilling to teach it. It is dangerous for an occasional operator and one unfamiliar with asepsis and operative technic to do any major operation. I believe that the open method should be taught, but, at the same time, the physician and occasional operator should be alive to the fact that an operation for fracture of the patella is not a minor one, involving, as it does, the largest and at the same time one of the weakest joints in the body, and that if infection does occur, it may end most disastrously. Consequently it is an operation accompanied with a certain definite risk, and one probably attended by much more danger than a simple appendectomy, as the

synovial membrane does not seem to possess the protective power of the peritoneum in taking care of a slight infection.

The best time to operate is now thought to be after all oozing has ceased, after the exudate has reached its height and has even begun to subside, and the tissues have had time to become sealed off. This process usually takes from six to ten days, but it can be hastened somewhat by placing the leg on a posterior splint, with elevation, and the application of an ice bag. In reviewing the histories of these cases, the temperature charts, as a whole, failed to show any marked difference between those operated upon early and those in whom the operation was delayed. The immediate success of these cases depends entirely on whether or not infection occurs. This, I believe, rests between the resistance of the tissues, the virulence of the infection, if one does occur, the preparation of the patient, and the operative technic. Dr. Murphy has pointed out that in an early operation the surgeon is working in tissues somewhat devitalized and, therefore, less resisting and more apt to become infected.

In a letter, which I quote with his permission, Dr. Murphy says: "My reason for postponing the operation for six to ten days is to give the synovial membrane an opportunity to react to the irritation of the trauma and the irritation of the blood-clot in the joint. This reaction produces a cofferdamming of the lymph spaces in the subendothelial layer of the synovial membrane, and lessens the danger of infection very materially."

"We resorted to an injection of 10 c.c. of formalin and glycerine into the joint, immediately after the fracture. This produces a chemical irritation, increases the number of polymorphonuclear leucocytes in the joint, and increases the constitutional polymorphonuclear reaction. It also cofferdams the lymph spaces and insures a prophylaxis against infection. The operation is then done five to seven days after this injection."

Theoretically, with perfect technic, there is nothing to gain by delay other than to allow the oozing, especially from the torn synovial membrane, to cease, as this in an early operation

can be quite annoying. Practically, however, we know that our technic is not always perfect and that infection does sometimes occur. This is lessened by a late operation and, likewise, I believe, the patient suffers much less the first few days after the operation, and the convalescence is shortened, as there is less local reaction.

The incision should be elliptical. It makes little difference if the convexity is above or below. Some surgeons claim the convexity should be above, as it takes the scar away from the knee and is less apt to cause pain with the patient in the kneeling posture. Of the cases I was able to follow, I was unable to substantiate this claim. I think the incision should be an elliptical one, preferably below, as a greater exposure can be obtained well away from the line of fracture, and it lessens the chance of infection and after-complications, especially if silver wire is used. The incision should be carried well down on either side, as I shall point out later, to permit drainage. The next step in the operation, after reflexing well the skin flap, is to divide the prepatellar bursa and fascia lata. The clots are now swabbed out with dry gauze, no fluid being used, and if any irrigation is necessary, only saline solution or sterile water should be employed, as bichloride or other devitalizing or irritating agents are apt to increase the flow of serum and favor infection. The reflected tendon over the broken edges is now retracted, the frayed ends rounded, and by blunt dissection separated a short distance from the margin of the fracture. Often this is impossible on account of the small fragment. The raw surface of the patella should next be freshened, especially in late operations, to get rid of the adherent organizing clot. With a hand drill, beginning in the centre of the upper fragment about one centimetre from the margin of the fracture, a hole is drilled obliquely downward so as to emerge on the broken surface just at the point where the dense cancellous tissue and thin compact lamina unite. A similar opening is drilled in the lower fragment. Through these two holes a silver wire is passed, the fragments are brought together as accurately as possible, and the wires

twisted one or two times; the redundant wire is cut off, and the twisted ends that remain are reflected upwards under the tendon and gently hammered down. Some operators use two wire sutures, one being placed on either side of the patella. The tendon is next sutured with chromic gut, and likewise the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule. At the lower angle of the wound, if the rent in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule does not extend so far down, an opening should be made to permit drainage. The prepatellar bursa and fascia lata are next sutured with chromic gut and the skin by interrupted silkworm gut sutures. The skin wound should not be sewed too tight, neither should too many stitches be applied. The angles of the wound corresponding to the openings in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule should be left open. As a rule, this procures sufficient drainage, but if there has been much oozing, a few strands of silkworm gut or a small piece of rubber tissue can be inserted. The leg is now placed on a well-padded, slightly convex, posterior splint until the patient has fully recovered from the effects of the anæsthetic, when the splint is removed and the leg is placed on a pillow.

The point that I wish to emphasize in the operative technic is the advantage of silver wire. Out of the thirty cases that I have been able to follow, four refractured the patella; three of these were sutured with absorbable material. The one that refractured with wire was due to a fall downstairs, and so great was the strain thrown upon the patella, that the wire cut through the upper fragment. Silver wire is certainly the most aseptic and at the same time the strongest suture material that can be used. The only disadvantage is that it occasionally has to be removed. Removal was necessary in three cases in this series. This undoubtedly can be avoided, provided no infection occurs, but even if skin infection—the most common in this operation—does occur, if the skin incision is well away from the line of fracture, and if the ends of the wire are not left too long and are well covered by the tendon, fascia lata,

and prepatellar bursa, removal of the wire may not be necessary. If the wire has to be removed, however, it can be easily done with little inconvenience to the patient. That wire causes softening of the bone around the opening is highly improbable unless some infection occurs. Wire is certainly no more irritating than any other material used in these cases, as kangaroo tendon, chromic gut, or even, as has been used, silkworm gut.

Cotton, in his excellent book on "Dislocations and Joint Fractures," states that refracture after the eighth week is rare. Only one of this series occurred in that time; the others ranging from four months to four years.

Is bony union obtained in a fracture of the patella? Some surgeons claim not. Personally, I have never examined a sutured fractured patella under the microscope and cannot say. In one of these cases I removed a wire one year after operation. I took the opportunity, clinically, to examine the union and to all appearances it was bony. In this case, even though there had been a slight skin infection followed by a persistent sinus for several months, the bone did not appear soft around the wire, and it took quite a "tug" to dislodge it. As shown by the refractures occurring in this series, the bony union, if one is obtained, is not strong. Why then not reinforce this with a non-absorbable suture?

The after-treatment of these cases is most important. The splint is removed as soon as the patient has recovered from the effects of the anæsthetic, or, preferably, it can be left on through the first restless night following the operation. On its removal, the leg, slightly flexed, is placed on a pillow. Gentle passive motion is begun in a day or so. As it is possible to move the leg through an angle of five or ten degrees without moving the patella, this much motion is taken advantage of. The passive motion is gradually increased so that by the third week the leg can be flexed to a right angle. In the last case that I operated upon, the patient could flex the leg to a right angle on the tenth day, was allowed out of bed on the twelfth, and walked the next day. He was discharged, walking, from the hospital on the sixteenth day. It is a mis-

take to keep the leg for weeks on a splint or in a cast. Not only does the patient lose much time by the delay, but the muscles become atrophied and the knee more or less ankylosed. These patients will tell you that they were a year getting a useful limb. Of the ultimate end results, say one year after operation, there is little to choose between. All that I was able to follow got a fairly good functioning result. Some complained of a little stiffness or weakness in the knee on flexion or extension. A few complained of pain in the knee before a storm. On the whole, all showed excellent results; especially was this true of the five private cases operated upon by Dr. Deaver. These patients were treated by the above method, and so excellent were the results, that one would never know, except on close examination, that they had a fracture of the patella. The others, in all probability, would have had as good a result if they could have been properly carried through the late after-treatment.

In this series, two cases died, both from sepsis. One was operated upon on the fourth day, the other on the thirty-fifth day following the accident. The first, a woman, had an abortion ten days before the accident, and when operated upon, unknown to the surgeon, had a bad discharge from her uterus. Whether this patient died from a primary infection or one occurring through her blood, it is hard to say. Her knee did not show much inflammatory change for several days after the operation, although she was profoundly septic. Repeated blood cultures were negative. A culture taken from the knee, however, showed a bacillus morphologically resembling the Klebs-Löffler. Everything possible was done to save this patient's life. Her leg was amputated three and one-half months after the primary operation, but she died two weeks later of exhaustion. The other death occurred in a man who was operated upon five weeks after the accident. I saw the operation performed and the technic was apparently faultless, but evidently some error occurred, for the knee became infected, and the patient died two months later of sepsis.

The majority of cases operated upon showed a febrile

reaction ranging from 99° to 102° a day or so after the operation, but the fever usually subsided by the fourth to the sixth day.

In those cases badly infected following the operation, the best chance of saving the patient's life is by early laying open the joint and packing with iodoform gauze.

Some surgeons claim that in comminuted fractures a conservative method of treatment should be used. This rule, as all others, has its exceptions. In one fracture that I operated upon, due to a kick, the patient fell after the blow and evidently tore the fibrous expansion of the quadriceps tendon. In another case, due to a fall from a distance, there was little tear of the fibrous expansion of the quadriceps tendon, but the fragments were tilted and separated by the effusion and clot. These two classes of cases should certainly be operated upon; in the first instance to repair the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, and in the second, to adjust the fragments and to turn out the clot. In comminuted fractures, especially if broken in many pieces, suturing the bone is often impossible, and the best that can be done is to suture the tendon and carry the patient through a prolonged convalescence.

In the letter referred to above, Dr. Murphy also says: "In cases where the patella is badly fragmented, we believe the use of a flap three-fourths of an inch wide and four and one-half inches long, from the central portion of the quadriceps tendon, passed over the patella and inserted into the ligamentum patellæ by splitting it and looping it half way around, is the most secure means of holding the patella. It does not then involve the traumas in the joint nor the presence of foreign material, such as wire or plates. It is one of the simplest means of treating these fractures, and I believe one of the most secure, following out the plan I do in my cases of resection of the patella for tuberculosis."

In fracture of the patella, if bony union does occur, close approximation of the fragments is essential. This close approximation cannot always be gained by simply suturing

the tendon and not the patella, as effusion or movement may dislodge the fragments. In suturing with an absorbable material, a close approximation is possible, but often these sutures soften, elongate, become untied or even break; especially is this so, if close approximation is not obtained and the fragments move independently of each other. In using absorbable material, passive motion must be delayed and the patient is compelled to pass through a slow convalescence, followed by a more or less stiffness of the joint that usually lasts for several months, to say nothing of the loss of time which many of them can ill afford.

Total number of fractures of the patella.....	56
Males	37
Females	19
Males fracturing right patella	18
Males fracturing left patella.....	19
Females fracturing right patella.....	8
Females fracturing left patella.....	11
Variety: transverse fracture	50
Comminuted fracture	6
Suture: silkworm gut	1
Chromic gut	15
Kangaroo tendon	2
Silver wire	31
After treatment: plaster case	15
Splint	8
Splint and case	9
Pillow	17
Splint (not operated).....	7
Causes: slipped	27
Fell	27
Kicked	2
Tendon alone sutured.....	3
Refractures: absorbable suture.....	3
wire suture	1
Operated upon	49
Not operated upon.....	7

REPORT OF CASES.

E. W., age 42; female. Transverse fracture of patella of left knee; caused by slip. Operation 6 days later; silkworm gut suture; cast. In hospital 57 days. Highest temperature 99.3. Recovered.

S. B., age 20; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 27 days. Highest temperature 100.3. Recovered.

S. B., age 27; female. Transverse fracture of patella of right knee; caused by slip. Operation 2 days later; wire suture; splint and cast. In hospital 45 days. Highest temperature 99.4. Recovered.

P. N., age 43; male. Comminuted fracture of patella of right knee; caused by fall. Not operated; splint. In hospital 50 days. Recovered.

J. S., age 48; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; splint and cast. In hospital 33 days. Highest temperature 101.2. Recovered.

A. F., age 38; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 85 days. Highest temperature 100.1. Recovered.

A. S., age 55; female. Transverse fracture of patella of right knee; caused by slip. Operation 20 days later; wire suture; splint. In hospital 50 days. Highest temperature 100.1. Recovered.

A. N., age 67; female. Comminuted fracture of patella of right knee; caused by slip. Not operated; splint. In hospital 35 days. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; kangaroo tendon suture; splint and cast. In hospital 14 days. Highest temperature 100. Recovered.

H. W., age 40; male. Comminuted fracture of patella of right knee; caused by kick. Not operated; splint. In hospital 30 days. Recovered.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; chromic gut suture; cast. In hospital 25 days. Highest temperature 100.1. Recovered.

W. W., age 44; male. Comminuted fracture of patella of left knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 31 days. Highest temperature 100. Recovered.

G. O., age 37; male. Transverse fracture of patella of left knee; caused by slip. Operation 14 days later; chromic gut suture; splint. In hospital 35 days. Highest temperature 102. Recovered.

A. S., age 54; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 28 days. Highest temperature 100.1. Recovered.

H. R., age 30; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

W. W., age 44; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 32 days. Highest temperature 99.1. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; kangaroo tendon suture; cast. In hospital 34 days. Highest temperature 100.2. Recovered.

F. S., age 28; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 25 days. Highest temperature 100. Recovered.

R. G., age 32; male. Transverse fracture of patella of right knee;

caused by fall. Operation 1 day later; wire suture; splint. In hospital 35 days. Highest temperature 100.1. Recovered.

M. H., age 77; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

E. G., age 50; male. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; chromic gut suture; cast. In hospital 26 days. Highest temperature 100.2. Recovered.

F. H., age 36; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

L. B., age 60; male. Transverse fracture of patella of right knee; caused by fall. Operation 18 days later; wire suture; pillow. In hospital 45 days. Highest temperature 100.1. Recovered.

W. K., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; splint. In hospital 35 days. Highest temperature 100.2. Recovered.

E. S., age 27; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 16 days. Highest temperature 99.4. Recovered.

W. H., age 40; male. Comminuted fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. In hospital 29 days. Highest temperature 100.1. Recovered.

E. S., age 45; female. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint and cast. In hospital 46 days. Highest temperature 100. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; cast. In hospital 25 days. Highest temperature 100.2. Recovered.

C. D., age 31; female. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 41 days. Highest temperature 100.1. Recovered.

W. M., age 40; male. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 15 days. Highest temperature 99.4. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; pillow. In hospital 17 days. Highest temperature 100.1. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; pillow. In hospital 12 days. Highest temperature 99.3. Recovered.

E. W., age 34; female. Transverse fracture of patella of right knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 33 days. Highest temperature 101. Recovered.

J. F., age 42; male. Transverse fracture of patella of right knee; caused by fall. Operation 3 days later; chromic gut suture; splint and cast. In hospital 32 days. Highest temperature 99.4. Recovered.

C. M., age 30; male. Transverse fracture of patella of right knee; caused by slip. Operation 6 days later; chromic gut suture; splint. In hospital 41 days. Highest temperature 101. Recovered.

W. L., age 18; male. Transverse fracture of patella of right knee; caused by slip. Operation 17 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.3. Recovered.

E. K., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 35 days later; wire suture; splint. In hospital 67 days. Highest temperature 105. Died.

J. F., age 53; male. Transverse fracture of patella of left knee; caused by fall. Operation 7 days later; wire suture; pillow. In hospital 27 days. Highest temperature 99.4. Recovered.

J. W., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 12 days later; wire suture; pillow. In hospital 35 days. Highest temperature 100.1. Recovered.

F. T., age 35; female. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 115 days. Highest temperature 105.3. Died.

J. R., age 19; male. Comminuted fracture of patella of left knee; caused by kick. Operation 4 days later; wire suture; pillow. In hospital 36 days. Highest temperature 100.4. Recovered.

A. T., age 45; male. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; wire suture; splint and cast. In hospital 28 days. Highest temperature 100.3. Recovered.

A. D., age 40; female. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; chromic gut suture; splint. In hospital 45 days. Highest temperature 100.2. Recovered.

J. O., age 33; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; chromic gut suture; cast. In hospital 22 days. Highest temperature 99.4. Recovered.

F. M., age 30; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 44 days. Highest temperature 100.3. Recovered.

E. W., age 49; male. Transverse fracture of patella of right knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 30 days. Highest temperature 100.4. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 6 days later; chromic gut suture; splint. In hospital 29 days. Highest temperature 100.1. Recovered.

T. G., age 22; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 30 days. Highest temperature 101.4. Recovered.

F. H., age 20; female. Transverse fracture of patella of right knee; caused by fall. Operation 9 days later; wire suture; cast. In hospital 38 days. Highest temperature 100. Recovered.

L. W., age 28; female. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; pillow. In hospital 34 days. Highest temperature 100.1. Recovered.

G. E., age 41; male. Transverse fracture of patella of left knee; caused by fall. Operation 5 days later; chromic gut suture; cast. In hospital 42 days. Highest temperature 101. Recovered.

M. A., age 39; female. Transverse fracture of patella of left knee; caused by slip. Operation 5 days later; chromic gut suture; cast. In hospital 61 days. Highest temperature 100.4. Recovered.

D. M., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.4. Recovered.

W. M., age 28; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. Highest temperature 101.3. Recovered.

G. H., age 42; male. Transverse fracture of patella of left knee; caused by slip. Operation 9 days later; wire suture; splint and cast. Highest temperature 98.3. Recovered.

DR. WALTER G. ELMER, with regard to the statistical showing that fractures of the patella were slightly more numerous in the left knee, said that in the Hospital for Ruptured and Crippled Children in a series of several thousand cases of tuberculosis in which traumatism was supposed to play a part, 55 per cent. had the right knee affected; another series was slightly in favor of the left knee. In a recent medicolegal case, the counsel for the defendant and the witnesses on that side took the stand that the injury was greatly in favor of the right knee. These figures are valuable as showing that such could not be said to be the case, but that one knee was as likely to be the seat of injury as the other.

DR. JOHN B. DEEVER said that his experience in the treatment of fracture of the patella agrees with the views expressed by Dr. Alexander. For the last two years he had adopted this method of treatment, and the results obtained had been better and the length of time in bringing about the result much shorter. Formerly it was his practice to put the knee up in plaster after wiring, taking the case off in ten days or two weeks, after the removal of which passive motion was cautiously made. He no longer uses plaster but treats as above stated.

DR. JOHN H. GIBBON said that in dealing with this subject Dr. Alexander had looked at it from a distinctly modern point of view. He had said nothing about the older ways of treatment, either the subcutaneous suture or the straight incision. He believed this is the way it should be looked at. The time has passed when, if the environment for operation is proper, the patient should be treated with a splint. Of course care must be exercised in the choice of cases, for it is in the non-observance

of this precaution that the mortality comes in. It is plain that alcoholics, syphilitics, and others offering general contraindication to operation should be excluded.

With regard to points of personal technic, his preference is for an incision going below the fracture at least an inch, for then in case infection should occur, it is not immediately over the line of fracture, and moreover if a refracture occurs, it is not a compound one. He had only used a straight incision once and a silver wire suture but once. He was very much impressed with Dr. Blake's article of some years ago on this subject, which emphasized the fact that the rupture of the lateral ligaments was often the most important part of the lesion, from a pathological point of view certainly one of the most important, and should therefore receive particular attention. He suggested suture of the lateral ligament and suture of the ligamentum patellæ without suture of the patella itself. Dr. Gibbon had done this in all his cases recently. The silver wire suture will not prevent a patella from breaking if it is going to break after a number of months. It is, however, the most aseptic suture that can be used. He sutured only the lateral ligament and the ligament over the patella. The mere fact that Dr. Alexander says refracture occurs late, usually after the eighth week, is against the use of non-absorbable sutures. Although in his last few cases he had used no drainage, he believed it to be a good method not to put the sutures in too close or too tight—to allow a certain amount of drainage in this manner.

Regarding the splint, after learning from Dr. Alexander what he had been doing, in his last case he took the splint off the second day, but the patient wished it replaced because he felt more comfortable with than without it.

If the fragments are exposed and the fibrous tissue is taken away, perfect bony union will result, and there is no necessity for keeping splints on for months. Early motion is the secret of the ultimate success in these cases. Those cases in which it is not employed ultimately get the same result but not so quickly.

DR. HARRY C. DEEVER said that the most important point in Dr. Alexander's paper was the after-treatment. He had not used the plaster case for a fracture of the patella for six years, nothing but silver wire. This fixes the fragment and makes it

possible to begin passive movements early, often at the end of the seventh day. It is his rule to make general passive motion with light massage. These cases were able to get out of bed at the end of eighteen days and to flex their legs to a right angle shortly afterwards, and were discharged in four weeks.

He had had five cases in his private practice, and at the end of five weeks he considered each patient practically well. He would not advise flexing of the knee very strongly at an early date without suture of the fragments with silver wire.

DR. GEORGE G. ROSS had had one unfortunate experience so far as the incision for operation is concerned. He had always used the straight incision following Dr. Deaver's practice, but after hearing a discussion recommending the horseshoe incision, he had a patient, a stout woman, at the Germantown Hospital, upon whom he made a big wide horseshoe incision and wired the patella. On the fifth or sixth day gangrene of the flap developed, with infection of the knee-joint, and subsequent death of the patient. He therefore became a little skeptical regarding the propriety of this incision. He still believed the straight incision gives ample room and does not jeopardize the blood supply of the superficial fascia.

DR. JOHN H. JOPSON said that there was one point which had not been brought out with regard to the use of silver wire, which he thought to be of importance. Its use requires a drilling of the bone, which suture of the capsule does not. He formerly practised suture of the capsule alone, but in his recent cases he had drilled the fragments and used silver wire, as it seemed to him such treatment might stimulate the osteogenetic function of the bone, even as in ununited fractures.

DR. GEORGE P. MÜLLER reported a case of recurrent bilateral fractures of the patella; the patient was shown to the Clinical Surgical Society recently. The left patella was first fractured in November, 1906, and was wired with silver wire in the usual manner; in January, 1907, a refracture of the patella occurred, and it was again wired. In April, 1907, as a result of a misstep, the patient refractured the patella again and this time it was fastened with chromic gut and has since remained united. In February, 1910, he fractured the right patella and on the ninth day after the accident this was sutured with chromic catgut and has since remained united. The patient stated that in 1906,

at the time of his first fracture, his brother was operated on in the German Hospital with a fracture of the right patella which was refractured in 1909.

Dr. Müller had also seen a fracture of the patella caused by the kick of a horse, in which the lower half inch of the bone was fractured, without, as far as he was able to see, opening the joint. The fragments were in fairly good position, the lower end being tilted somewhat backward, but owing to the fact that the patient was very insistent that he should be able to ride horseback without trouble in the future, he advised operation and fastened the fragments with chromic gut. The patient was placed on a posterior splint for three or four days, a plaster cast was then applied, and on the tenth day he was allowed to walk on crutches. The cast was removed three weeks after operation and the patient allowed to walk, but he complained of inability to raise the foot and toe-drag, and upon examination he was found to be suffering from paralysis of the external popliteal nerve. The case was perfectly fitting and properly padded, and accordingly the speaker believed that the nerve was injured at the time of the accident with the kick of the horse.

In addition to the possibility of infection to the joint if the skin incision is placed immediately over the line of operation, as has been mentioned, it should be added that the scar in the skin is liable to adhere to the scar in the fascia and cause more or less trouble. A wait of two weeks at least should be observed before attempting any motion. It has been emphasized that the most important part of the operation is the suture in the torn aponeurosis and as fascial tissues are not very well vascularized they should be given time to firmly unite. One does not, as a rule, allow patients operated upon for hernia to go about until the second week, and yet as a matter of fact there is less strain in these cases than in the flexion and extension of the knee-joint. If the torn aponeurosis is carefully and accurately brought together, it does not matter whether one uses silver wire, copper wire, or catgut in the patella, or whether one does not drill the patella but simply uses the mattress sutures of Blake or the circumferential suture. Personally, he preferred to drill the patella, for the reason mentioned by Dr. Jopson, *i.e.*, that it may have some influence in promoting bony union. The majority of surgeons have found silver wire unnecessary, but if an operator gets good results with silver wire he should use it.

DR. JOHN H. GIBBON remarked with regard to the horseshoe incision, that in all his early cases where he used the horseshoe-shaped incision he had no sloughing, but he realized it was wrong, and since then his incision had been more semilunar. He intended, when speaking before, to refer to a case of peroneal palsy, which he was sure was due to the splint. The patient had had no plaster cast, he was a very thin man; he complained of great pain over the peroneal nerve. When the splint was removed he had toe-drop, from which he very slowly recovered.

DR. A. P. C. ASHHURST said that if it was desired to get patients walking by the fourteenth day it was well to use silver wire, as union cannot be firm then. On the other hand, if they can wear a removable plaster cast, and have massage by an adequate masseur, with passive motion, it is sufficient to use chromic catgut for sutures.

A second point is that among 49 operations there were two deaths, a fact which should not be overlooked. These operations were done in one of the best hospitals, with the best surgeons and best assistants and nurses. Within the last few weeks there has been reported from Boston a series of arthrotomies for fatty tumors of the knee-joint. The mortality from infection was about 4 per cent. Lucas-Championnière, who despises asepsis, swabs out his knee-joints with carbolic acid, and claims to have done more than 80 operations for fracture of the patella without a single death. Perhaps, therefore, the aseptic is not so good as the antiseptic method.

DR. LEWIS W. STEINBACH exhibited a patient operated upon for fracture of the patella who was operated upon six weeks before, four days after her admission to the Polyclinic Hospital. The large effusion of blood into the joint was washed out, the edges of the lacerated tendon and of the ligaments were trimmed, then the widely separated fragments of the transversely fractured patella were brought together through the fascia anteriorly and laterally of the patella. The joint was fixed with a thin silicate of soda dressing re-enforced by a posterior thin splint of wood, and then interrupted catgut sutures for the integument.

After 39 days spent in bed, the splint was removed. The bone was firmly united as shown by the skiagraph, the sutures were absorbed, and the joint had a fair degree of free motion. Patient can now walk with the aid of crutches, and it is reasonable

to expect that she will soon possess normal use of the extremity.

DR. EMORY G. ALEXANDER (in closing) said, with regard to the mortality, that although the two deaths make a large percentage in this series, he felt that with the great work being done by Dr. Murphy on the knee-joint, and the advance made by English surgeons, the technic is bound to improve, and that with these improvements will come a decrease in the mortality rate.

As far as drainage is concerned, he did not advocate it as a routine measure, but occasionally there will form an extra-capsular collection due to oozing which must be removed. As to the comfort of the splint, with his patients it has always been the opposite, they saying that the pillow is much more comfortable as it allows of freer movement. There is a certain degree of motion of the knee, about 5° or 10°, which can be gradually produced without using the patella at all, and this is the motion advocated for the first few days, not forcibly flexing the knee. The majority of refractures occur after the eighth week, a point which shows the value of silver wire suture.

THE OPEN TREATMENT OF FRACTURES.

DR. EDWARD MARTIN made some remarks upon this subject.

FRACTURES OF THE SHAFT OF THE FEMUR
WITH MARKED DISPLACEMENT.

BY RICHARD H. HARTE, M.D.,
OF PHILADELPHIA,
Surgeon to the Pennsylvania Hospital.

It would appear that fractures of the shaft of the femur have not received the careful attention and study which they merit, perhaps because it is rare that a surgeon in active professional life sustains an injury to this bone, with the possible exception of those who ride horseback, or, again, it may occur as the result of an automobile or railroad accident.

Much time and consideration have been given to the study of enlarged prostate, appendicitis, and like pathological conditions, to any of which all classes and professions are liable. And, with these commoner affections constantly in mind, it is little wonder that the femur should not, of late years, have received the attention which it really deserves.

Fracture of the shaft of the femur is not, on the whole, a very common injury, and our experience in its repair is almost entirely confined to our hospital practice rather than in our private surgical work. Of course, it must be understood that we are dealing with fractures of the shaft of the bone occurring in the active years of life and not with fractures of the neck of the thigh, which occur so commonly in persons past the meridian.

The question now to be considered, in a measure, after an accident of this description is: *Is the limb after treatment in as good condition and position as it was before the accident, following what is accepted as good results?*

It is the generally accepted opinion that from one-half to one inch shortening of the limb is a fairly satisfactory result,

but with this we shall often find considerable rotary displacement and angularity, which, if low down, frequently interferes with the function of the knee-joint, due to an excess of callus, which can be readily felt at the seat of injury.

A careful study of the museum specimens of this injury is very instructive and is calculated to modify one's previous conception of what actually takes place and what constitutes a good result.

I think the general belief among many surgeons (who should know better) is, that with general anaesthesia, it is quite possible in a transverse fracture to get good end-to-end apposition of the fragments and keep them in perfect position by means of weights and pulleys, sand bags, etc., and that a nice, spindle-shaped lump of callus will surround and hold the ends of the broken bone together, and that the leg will be as good as ever after the injury.

It may seem a homely comparison, but no person of reasonable intelligence would say that the broken leg of a piece of furniture is as good or as perfect, no matter how well repaired, as it was before being broken. And the same analogy holds good as regards the femur that has been fractured.

Let us consider for a moment some of the actual conditions which confront us, as illustrated by an X-ray photograph or any selected museum specimen.

And here a word of caution must be offered in regard to the way in which the X-ray photograph is prepared. If the tube is not directly over the seat of fracture, the deformity may be enormously exaggerated, and it is always well to have the picture taken from several points of view, as an incredible amount of misinformation may be derived from the study of only one picture.

There is always varying degree of deformity, due to overlapping of the fragments.

The lower fragment may be either in front or behind, inside or outside the upper fragment, but is never exactly where it should be, if absolutely accurate reduction of the bone had been effected.

There is invariably a certain amount of rotation and the alignment is never absolutely perfect.

It is impossible to determine by the unaided eye, touch or measurements, what the actual displacement of the fragments is. The great mass of muscles surrounding the bone, the enveloping skin and fascia and possibly extravasated blood all combine to soften the irregularities of the real outline, just in the same way as a fresh fall of snow smoothes out and diminishes inequalities of contour in a landscape.

It is, therefore, impossible to gain any appreciable idea of the extent of bony displacement which exists in these injuries without first having a carefully prepared X-ray picture.

If one will carefully study a specimen, he will have little difficulty in understanding why these patients complain of pain and weakness in the limb, of lameness, of coldness and œdema of the feet, and why the functional activity of the limb must necessarily be greatly impaired. And careful thinkers must feel that a fracture of the femur in the active years of life cannot but be a serious injury, and should demand the careful consideration of all surgeons who are treating these injuries.

It seems to the mind of the writer that the time is ripe for breaking away from the old, accepted traditions and teachings of the great men of the past: to wit, that shortening of an inch or more is the inevitable outcome of such injuries, and that nothing can be done to prevent it.

In the words of Sir Thomas Myles, who has dealt very ably in an exhaustive paper on this subject, "Are we not bound, as surgeons, to avail ourselves of all the advantages that progress in other directions has made possible for us? Is the technic which has made safe the great operations in other branches of surgery not to be utilized in this important part of our work?"

I feel that, in dealing with all cases of fracture of the shaft of the femur in persons in the active years of life, the facts should be stated frankly and plainly to the individual, and he should be made to understand clearly the risks and advantages, on the one hand, and the freedom from risk

and the disadvantages, on the other, and it will be seldom that the active, intelligent patient will not decide to place himself in our hands, with the hope that the realization of the perfect result may be obtained.

Now the question arises: How are we to obtain the ideal result in the treatment of fractures of the shaft of the femur in persons who expect or hope to continue leading an active life?

I feel confident that there is no positive or definite line of treatment open to us, except the exposure of the fragments of the bone by a formal dissection and the restoration of the fragments, actually seeing the parts perfectly dovetailed back in their original position, which is positive assurance against rotary displacement and the first step toward procuring good alignment.

The X-ray is a perfect index of overlapping and shortening, but is of little or no use in determining the question of rotary displacement.

The writer is thoroughly aware, in urging this more radical method of treatment, that he is assuming a great responsibility, which may be diminished by certain limitations.

In the first place, the operation should not be undertaken except by skilled operating surgeons, who are in the habit of doing daily operative work in the hospital. This operation should not be undertaken in private houses, except under very perfect conditions, and should never be attempted on any but reasonably strong and healthy subjects. The operator should have at his command a perfect technic, with suitable instruments and skilled assistants.

Several methods might offer themselves for our consideration: such as wiring the fragments together; the introduction of an intermedullary splint; the use of absorbable pegs of bone or ivory, or some modification of Parkhill's screws and clamps; and lastly, the use of a steel plate and screws as recommended by Mr. Lane.

Time will not admit of discussing all the above mentioned methods, some of which are rarely employed.

The older method of suturing with wire, by drilling the ends of the bones and simply passing the wire around, has been in vogue for many years. It is open to certain objections, particularly in transverse fractures, as it does not retain the fragments in absolutely perfect position and presents more the character of a flail joint, and does not offer the amount of support that is so imperative in dealing with these cases.

However, in long oblique fractures, conditions are different, and the introduction of a wire through a hole drilled in the two fragments and then passing around the bone possibly two or three times to make a sort of ferrule, will suffice often to hold the splintered fragments in position.

Beyond this, the wire is not desirable in dealing with this class of injuries. The use of the wire can be facilitated greatly by using a heavy curved needle, which enables the operator to circle the bone without doing appreciable damage to the soft parts.

The plate and clamp method, as advocated by the late Dr. Parkhill, offers many advantages, inasmuch that the wound can be practically closed and the plate left on the outside of the soft parts, and, after union has taken place, these screw supports can be readily removed and the wound will heal up in a very short time. It may, however, be open to the objection that the wound can never be absolutely closed during the process of repair; and it plays very much the same part, in the support of the femur or humerus, that the unfractured fibula does in the support of the tibia when the latter has been broken. It is a most ingenious method and deserves worthy consideration in dealing with this class of injury.

The later method, which has been brought into such prominence by Mr. Arbuthnot Lane, is the one which to-day is receiving the greatest amount of attention.

It consists in the use of long, steel screws, four to six in number, according to circumstances, fastening a strong steel plate which holds the bones rigidly in accurate position one with the other, and which is allowed to remain in the wound after it has been closed, thereby assuring absolute sup-

port to the broken ends during the process of repair. In many cases, the plate may be worn by the patient indefinitely, without causing any discomfort or inconvenience, but if irritation should arise from this, it is open to the objection that it must be removed by a second, though trifling, operation.

The essential feature of all these methods mentioned is the perfect and accurate reduction of the displacement by extension in some form, which is often very difficult, particularly if it is an old injury where attempt at repair has already been made.

To facilitate this, the method devised by Dr. Martin of making extension directly on the upper end of the lower fragment in the wound and drawing it down by extension weights or pulleys, is one of the very best means at our command of correcting the deformity, so far as the actual extension is concerned.

The writer is disposed to regard this method as preferable to the extension of the leg by the use of pulleys, etc., as before recommended in another communication.

Dr. Martin has devised an ingenious pair of clamps which, after the ends of the bones have been accurately adjusted, facilitates the application of the plate and the introduction of the screws. I think this can again be very much modified by the use of curved retractors. This enables the operator to free the bone from any old adhesions, particularly on the opposite side of the wound, and then hold it accurately in position after the readjustment and while the plate is being applied. These retractors, by their simplicity, are preferable to many of the heavy forceps and clamps which have been devised.

The greatest care must be exercised to see that the drill and the screws accurately correspond to each other in size and length, so that the screws will have accurate bearing along their entire course. Care must also be taken to see that the screws are not so long as to perforate the opposite side of the bone, and it is advisable always to have a number of screws of different lengths, corresponding to the size of the bone to be dealt with.

Before dismissing this subject, the site of the incision is worthy of consideration. The wound, which must necessarily be large, is preferably made on the outer side of the quadratus femoris muscle on the anterior surface of the thigh, rather than on the outer side of the leg between the line of the flexor and extensor groups of muscles. The latter incision has the advantage, however, of allowing the more perfect drainage, but the anterior wound can be readily drained by making a counteropening directly down through the muscles, through which a small wick of gauze can be introduced and retained for forty-eight hours, which insures rapid removal of all serum which necessarily collects after so large a wound, thus minimizing the possible risks of infection.

It is important also that, in closure of the wound, all dead spaces should be obliterated as much as possible by the introduction of deep buried catgut sutures.

Mr. Lane lays great stress upon using instruments with as long handles as possible, so as to obviate introducing into the wound even the gloved hand, thus minimizing possible risk of infection.

When the patient is placed in bed, the limb should be thoroughly supported by long lateral supports, either splints or a plaster case, to insure absolute rest of the parts. If this method of treatment is carried out, it will be found that the limb will correspond accurately in measurements to the sound limb, both with regard to length and position. All muscular spasm disappears, as we have no irregular or ragged ends of the bones to cause irritation to the soft parts.

In concluding these remarks, the writer does not wish to advocate the open method of treatment in all cases of fractures of the shaft of the femur, but only in those cases where it is impossible to get reasonably accurate approximation of the bones, as can be readily shown by the use of the X-ray photograph.

This method is not applicable to very young children nor to old or enfeebled persons, but only to those who are in good health and whose habits of life would naturally tend toward a favorable result.

The greatest care must be exercised, not only as to the method of technic employed, but in determining whether or not one's patient will co-operate with every effort of the surgeon to bring about a perfect result.

Too great emphasis, then, cannot be laid upon the importance of dealing with these cases as soon as possible after it has been demonstrated by the X-ray that the ends of the bones are not in accurate position, because the difficulty of the operation is greatly enhanced by allowing these cases to remain for several weeks before operating, in the hope that, by weight and extension, the bones will be brought into better position. The many adhesions and new callus resulting from this delay all add untold difficulties in attempting to bring the ends of the bones into position.

Finally, may I be permitted to offer a word or two of advice to those who may desire to practise some of the suggestions which I have made and who are without any practical experience in this line of work?

1. Find out all that is possible about the seat of fracture by the use of carefully prepared X-ray plates, the pictures to be taken at various angles.
2. Consider carefully what method you think is likely to give the best results.
3. When the fragments are exposed, have a proper pair of calipers to determine the diameter of the bone, and see that the screws in no case penetrate the opposite side.
4. Be certain that you have suitable instruments, proper drills and screws, and also competent assistants, so that you can complete the operation quickly and with as little destruction to the soft parts as possible.
5. Be sure before closing your wound, that it is thoroughly dry and that all dead spaces are obliterated, so that there will be no possible chance for the development of a small hæmatoma, which is so conducive to later infection.
6. Remember in dealing with this class of surgery, that the parts are hard and unyielding, and everything must fit accurately and securely. Nothing can be drawn or pulled

into position, as in dealing with the soft parts. Do not trust too much to nature with the hope that she will correct defects in your joiner work.

7. If possible, try and practise this operation on the cadaver before trying it on the living.

NOTE.—In reviewing a certain number of cases treated after the method above described, the author finds that care must be exercised not to allow the patient to bear his weight upon a limb which is apparently in good shape, as the repair of these injuries requires much longer time than simple fractures, and the callus, though apparently strong, is in many instances soft and yielding; if the patient is allowed to walk too soon, lateral deformity will occur, due simply to the outward bowing of the limb, as the result of superinduced weight of the body.

In this case, it will be noticed frequently that the screws have drawn away from their attachment in the shaft of the bone, and the plate will be forced off at an angle corresponding to the bowing of the limb. Too great care cannot be taken to supplement the use of the plates by suitably applied splints and extension, which should be maintained all through the process of convalescence, thus obviating the tendency to displacement.

DR. JAMES K. YOUNG said that in the treatment of vicious and ununited fractures Lambott's method is an improvement over the Parkhill method. It consists in the use of screws, which are inserted directly in the bone without the use of the drill. The screws are drill pointed. The fracture is held in place with special forceps, by which they can be placed in better position, the apparatus held together with a part outside the soft parts, and, as has been demonstrated by Dr. Wills of Los Angeles, Dr. Robertson of Warren, Pa., and others, the fractures may be accurately set and held during union. After the apparatus has been in place for a time the screws may be readily removed by means of a key.

DR. GWILYM G. DAVIS said, relative to the method of approximation, that plates alone do not play such a very large part in

the approximations of these fractures. In a bone which has big ends and is small in the middle, the ends are cancellous and the shaft is compact. A fracture of the ends is almost always transverse, and therefore the displacement is not great and the necessity of marked fixation at the ends does not exist. But in fractures of the shaft it is a different proposition. Compact bone is to be dealt with, and usually a fracture through compact tissue is oblique. In case of a transverse fracture in the shaft, a medullary splint should be used as Murphy has done. As regards the method of separating the fragments, it can be done by bending them up, and the splint can be sprung into place. In fractures of the shaft of the femur one cannot put on plates strong enough to hold them without the aid of outside force. Here a plaster-of-Paris bandage or outside splints are strongly indicated.

DR. JOHN B. ROBERTS said that the speakers seemed to be more sure of the reliability of measurements of the lower extremities after fracture than he was. A good many years ago he and others measured the bare bones of the lower extremities, and found that in limbs never subjected to fracture there was a marked difference between uninjured femurs and tibiae of the same individual. With even a considerable difference in the length of the lower legs, whether it be in the femur or in the tibia, the individual may walk with very little limp. Personally he paid very little attention to measurement of the legs after fracture of the thigh, but depended upon his eye as to the approximate amount of shortening, when he had the patient lying in bed with the pelvis straight. Although he used X-ray pictures for confirming the clinical examination, he realized that they may be very deceptive, and should never be used in court without the recognition by all parties that an expert radiographer may make very deceptive pictures. Such deceptive pictures are very likely to be made, unless the man who takes them knows the anatomy of the region and the probable site of the fracture before the exposure to the X-ray is made and takes plates in two planes.

Nature approximates symmetry in the skeleton, but hardly ever reaches it. X-ray plates are an assistance in surgical work, but the results must be checked up by clinical examination, by inspection, palpation, etc. He had long advocated the open treatment of fractures under special circumstances. He was inclined to believe, however, that it is by no means true that

the majority of fractures should be treated by open method. Many fractures of the femur, in addition to permanent traction to overcome shortening, need lateral support by plaster-of-Paris or other splints. The cases which are particularly likely to require incision and open treatment are the fractures near the junction of the upper and middle third of the femur, where eversion and flexion at the hip-joint are liable to occur from the action of the psoas and iliacus muscles.

He had noticed in this discussion that the word plaster "cast" has been used a good deal as a method of treating fractures. It is rather odd that surgeons are very apt to use this improper term. The encasements which are often used in fractures of long bones should never be called "casts." They are not casts. They are really moulds. A better term instead of plaster cast is gypsum encasement or gypsum splint.

DR. GEORGE E. PFAHLER presented a skiagraph made two weeks before, showing the remarkable power of nature to unite fractures. In this instance, the bones overlapped about one inch, and even then the sides of the two fragments were about half an inch apart. Nature has bridged this gap. When sending patients for examination, in dressings, the surgeon should mark on the dressings approximately the location of the fracture, so as to be able to bring the central ray over the line of fracture. To determine the position of the fragments stereoscopic plates should be made, or two plates should be made at right angles to each other. When this work is accurately done and properly interpreted there can be no error.

DR. A. P. C. ASHHURST said that the enthusiastic Mr. Lane and some of his colleagues in England seem to think that the results without operation are intolerable. Dr. Harte and Dr. Martin, however, believe that certain cases do very well without operation, and recommend operation only in certain selected cases. Two years ago with the aid of the interne at the Episcopal Hospital, Dr. Ashhurst traced six cases of fracture of the femur, including forty of the shaft, and they found that 60 per cent. of the fractures of the shaft got a perfect result, while 32.5 per cent. more, making 90 per cent. in all, had no disability other than a slight limp. It seemed to him that those who advocate operation in all cases might at least publish the results of operative treatment, and let it be seen if in as large a series of cases as excellent results as these can be obtained.

DR. RICHARD H. HARTE (in closing) said that he agreed with all the gentlemen who had spoken in discussing these papers, but he would like to ask why is it that in all cases of fracture of the thigh Dr. Roberts has shortening? Is the broken leg always the short leg? Of course it is known that there is a certain amount of asymmetry in the results, but the man who treats a broken thigh without careful and accurate measurements is not giving his patient the best chance for good results.

With regard to broken plates, the trouble is that the plates ordinarily used are tempered too high, for if properly tempered and made of good steel it should be possible to bend them double and back again without breaking them. The old silver plates were far too easily bent and offered no support whatever.

Dr. Ashhurst speaks of a perfect result. What is meant by this term? Dr. Harte's idea of it is a limb that is perfectly straight, the patient walking without any limp, and no irregularity to be detected in the measurements. These are difficult to obtain.

He emphasized that he did not advocate that every fracture of the thigh should be opened and plated, but he did think this procedure to be indicated in cases where there is difficulty in keeping the fragments in position.

The mortality in these accidents should not be as great as they are in opening and wiring the patella, because in this latter operation there are two complicating conditions, a little bone to work on, and an opening into the joint in the body which is least calculated to take care of itself in infection.

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