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ACADEMY
OF
SURGERY

VOL. XXII.

1922

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TRANSACTIONS

OF THE

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ACADEMY OF SURGERY

VOLUME XXII

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1922

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The present volume of *Transactions* contains the papers read before the Academy from January, 1920, to December, 1920, inclusive.

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1880	D. HAYES AGNEW	1905	WILLIAM J. TAYLOR
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SECRETARY.

ELECTED		ELECTED	
1880	J. EWING MEARS	1905	JOHN H. GIBBON
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1896	WILLIAM J. TAYLOR	1920	J. STEWART RODMAN

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ELECTED

1880 THOMAS G. MORTON

Office abolished after 1889 by amendment to By-Laws.

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ELECTED

1880 WILLIAM HUNT
1891 WILLIAM G. PORTER

ELECTED

1904 JAMES P. HUTCHINSON
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1920 DUNCAN L. DESPARD

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ELECTED

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1881 DEFOREST WILLARD
1881 O. H. ALLIS
1884 C. B. G. DE NANCREDE

ELECTED

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1891 LEWIS W. STEINBACH
1902 JOHN H. GIBBON
1905 JOHN H. JOPSON
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1880 O. H. ALLIS

Office abolished after 1889 by amendment to By-Laws.

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ELECTED

1880 SAMUEL W. GROSS

Office abolished after 1889 by amendment to By-Laws.

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ELECTED

1880 JOHN ASHHURST, JR.
1880 JOHN H. BRINTON
1894 WILLIAM BARTON HOPKINS
1895 HENRY R. WHARTON
1898 THOMAS R. NEILSON

ELECTED

1900 W. JOSEPH HEARN
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1906 THOMAS R. NEILSON
1910 J. CHALMERS DACOSTA
1920 CHARLES. H. MITCHELL

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1880 JOHN H. PACKARD

ELECTED

1880 WILLIAM W. KEEN

With Recorder.

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ELECTED

1895 WILLIAM J. TAYLOR
1895 DEFOREST WILLARD
1896 RICHARD H. HARTE
1897 ROBERT G. LECONTE
1900 G. G. DAVIS
1902 JOHN H. JOPSON
1905 GEORGE G. ROSS
1908 FRANCIS T. STEWART

ELECTED

1914 JOHN SPEESE
1916 W. E. LEE
1916 MORRIS BOOTH MILLER
1917 D. B. PFEIFFER
1917 A. P. C. ASHHURST
1919 A. BRUCE GILL
1919 J. STEWART RODMAN
1920 ARTHUR BILLINGS

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1884–1891

D. HAYES AGNEW
SAMUEL W. GROSS
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1892–1893

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1894

J. EWING MEARS
JOHN ASHHURST, JR.
WILLIAM W. KEEN

With SAMUEL ASHHURST and WILLIAM HUNT to serve with them on distribution of the prize.

1895–1899

J. EWING MEARS
JOHN ASHHURST, JR.
WILLIAM W. KEEN

1905

WILLIAM J. TAYLOR
RICHARD H. HARTE
DEFOREST WILLARD

1900–1901

WILLIAM W. KEEN
J. EWING MEARS
J. CHALMERS DACOSTA

1910

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

1902–1904

WILLIAM J. TAYLOR
WILLIAM L. RODMAN
JOHN B. ROBERTS

1915

WILLIAM J. TAYLOR
JOHN H. JOPSON
EDWARD B. HODGE

1920

WILLIAM J. TAYLOR
JOHN H. JOPSON
EDWARD B. HODGE

ACTIVE FELLOWS OF THE PHILADELPHIA ACADEMY OF SURGERY

1910. †Alexander, Emory Graham, M.D., 1701 Spruce Street. Professor of Clinical Surgery, Woman's Medical College of Pennsylvania; Surgeon to the Episcopal Hospital, Mary J. Drexel Home, St. Christopher's Hospital, Philadelphia Hospital for Contagious Diseases; Assistant Surgeon to Kensington Hospital for Women.

1905. Allen, Francis Olcott, A.B., M.D., 2216 Walnut Street. Surgeon to the Presbyterian Hospital, Children's Hospital, and the Bryn Mawr Hospital.

*‡Allis, Oscar H., A.B., M.D., LL.D., 1604 Spruce Street. Consulting Surgeon to the Presbyterian, Roosevelt, and Oncologic Hospitals.

1906. Ashhurst, Astley Paston Cooper, A.B., M.D., F.A.C.S., 2104 Spruce Street. Associate Professor of Surgery, Medical School, University of Pennsylvania; Surgeon to the Episcopal Hospital, and to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases.

1917. Baldwin, James Harvey, A.B., M.D., 1426 Pine Street. Surgeon to the Methodist Hospital.

1915. Billings, Arthur E., M.D., 1703 Spruce Street. Demonstrator in Surgery, Jefferson Medical College; Chief Clinical Assistant, Surgical Department B., Jefferson Hospital; Assistant Surgeon to the Pennsylvania Hospital; Attending Surgeon to Bryn Mawr Hospital.

1898. Boger, John A., A.M., M.D., 2213 N. Broad Street. Surgeon to St. Mary's Hospital; Senior Surgeon to the Stetson Hospital.

1905. §Brooks, Charles Macy, M.D., 1321 Spruce Street. Assistant Genito-urinary Surgeon to the Philadelphia General Hospital.

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† Denotes year elected to membership.
* Died, May 16, 1921.
‡ Denotes Original Fellows.
§ Reported abroad, in Alexandria, Egypt.

1919. Brown, Henry P., Jr., B.S., M.D., 1822 Pine Street. Assistant Surgeon to the Pennsylvania Hospital, Presbyterian Hospital, and to the Children's Hospital; Instructor in Surgery and Assistant Instructor in Surgical Pathology, Medical School, University of Pennsylvania; Instructor in Surgery, Graduate School of Medicine, University of Pennsylvania.

1907. Carmany, Harry S., M.D., 366 Green Lane, Roxborough, Pa. Surgeon to St. Timothy's Hospital, Roxborough; Associate Surgeon to the Episcopal Hospital; Surgeon to the Dispensary of the Episcopal Hospital.

1909. Carnett, John B., M.D., 123 South Twentieth Street. Surgeon to the Medico-Chirurgical Hospital, Polyclinic Hospital, Philadelphia General, American Hospital for Diseases of Stomach, and Babies' Hospital; Assistant Surgeon to University of Pennsylvania Hospital; Consulting Surgeon to Municipal Hospital, Phœnixville (Pa.) Hospital, and to Burlington (N. J.) Hospital; Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Associate in Surgery, Medical School, University of Pennsylvania.

1916. Clark, John Goodrich, M.D., 2017 Walnut Steet. Professor of Gynæcology, University of Pennsylvania; Gynæcologist-in-Chief, University of Pennsylvania Hospital.

1919. Crossan, Edward T., M.D., 2104 Spruce Street. Associate Surgeon to the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Assistant Instructor in Surgery, University of Pennsylvania.

1896. DaCosta, John Chalmers, M.D., LL.D., 2045 Walnut Street. Samuel D. Gross, Professor of Surgery, Jefferson Medical College; Surgeon to the Jefferson Medical College Hospital; Consulting Surgeon to St. Joseph's Hospital and to the Misericordia Hospital.

1898. Deaver, Henry C., M.D., 1701 Spruce Street. Professor of Surgery in the Woman's Medical College of Pennsylvania; Surgeon to the Episcopal Hospital, and to the Children's Hospital of the Mary J. Drexel Home; Surgeon-in-Chief to the Kensington Hospital for Women.

1890. Deaver, John Blair, M.D., Sc.D., LL.D., 1634 Walnut Street. John Rhea Barton, Professor of Surgery, University of Pennsylvania; Surgeon-in-Chief to the Lankenau Hospital.

1908. Despard, Duncan Lee, M.D., B.S., 1806 Pine Street. Surgeon to the Methodist Episcopal Hospital, and to the Abington Memorial Hospital; Assistant Surgeon to Jefferson Medical College Hospital; Associate in Surgery, Jefferson Medical College.

1915. *Dickson, Frank D., M.D., F.A.C.S., 403 Waldheim Building, Kansas City, Mo.; Orthopædic Surgeon to the Christian Church Hospital, and to the City Hospital, Kansas City.

1916. Dorrance, George Morris, M.D., 2025 Walnut Street. Surgeon to the St. Agnes Hospital; Consulting Oral Surgeon to the University Hospital, and to the Philadelphia General Hospital; Consulting Surgeon to the Sacred Heart Hospital, Allentown (Pa.); Professor Maxillo-Facial Surgery, Thomas Evans Dental Institute, University of Pennsylvania.

1884. †Dulles, Charles Winslow, M.D., 4101 Walnut Street. Consulting Surgeon to the Rush Hospital.

1909. Elmer, Walter G., B.S., M.D., 1801 Pine Street. Associate Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Orthopædic Surgeon to the Jewish Hospital; Associate Orthopædic Surgeon to the Polyclinic Hospital; Surgeon to the Pennsylvania Training School for Feeble-minded Children at Elwyn.

1898. Frazier, Charles Harrison, M.D., Sc.D., 1724 Spruce Street. Professor of Clinical Surgery, University of Pennsylvania; Surgeon to the University Hospital.

1899. Gibbon, John H., M.D., 1608 Spruce Street. Professor of Surgery in the Jefferson Medical College; Surgeon to the Pennsylvania Hospital; Consulting Surgeon to the Bryn Mawr Hospital.

1914. Gill, A. Bruce, A.B., M.D., The Lenox, Thirteenth and Spruce Streets. Professor of Orthopædic Surgery, Medical School, University of Pennsylvania; Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Chief Surgeon to the Widener Memorial Industrial Training School for Crippled Children; Orthopædic Surgeon to the Episcopal Hospital, and to the Presbyterian Hospital; Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to the St. Edmond's Home for Crippled Children.

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* Denotes Non-resident.
† Deceased.

1914. *Ginsburg, Nathaniel, M.D., 160 Atkinson Street, Detroit, Michigan.

1902. Girvin, John H., M.D., 2120 Walnut Street. Gynæcologist to the Presbyterian Hospital; Associate Professor in Gynæcology, Graduate School of Medicine, University of Pennsylvania.

1892. Harte, Richard H., M.D., F.R.C.I., C.M.G., Companion of Order of Leopold, 1503 Spruce Street. Emeritus Surgeon to the Pennsylvania Hospital; Consulting Surgeon to St. Mary's Hospital, to the Memorial Hospital (Roxborough), and to the Abington Hospital.

1913. Hearn, William P., M.D., 2119 Spruce Street. Surgeon to the Philadelphia General Hospital; Assistant Surgeon to Jefferson Hospital.

1890. Hewson, Addinell, A.B., M.D., F.A.C.S., 2120 Spruce Street. Surgeon to the Memorial Hospital, Roxborough; Professor Anatomy and Histology, Temple University Dental School; Professor Anatomy, Graduate School of Medicine, University of Pennsylvania.

1916. Hirst, Barton Cooke, A.B., M.D., LL.D., 1821 Spruce Street. Professor of Obstetrics, Medical School, University of Pennsylvania; Staff of Howard Hospital, University of Pennsylvania Hospital, and Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to the Lying-in Hospital, to the Newport Hospital, and to the Pottstown Hospital.

1905. Hodge, Edward B., A.B., M.D., 2019 Spruce Street. Surgeon to the Presbyterian Hospital, and to the Children's Hospital; Associate Surgeon to the Pennsylvania Hospital; Associate Surgeon to the Widener Memorial Industrial Training School for Crippled Children.

1898. Hutchinson, James P., A.B., M.D., 133 S. Twenty-second Street.

1915. Ivy, Robert Henry, M.D., DD.S., 1503 Medical Arts Building, Sixteenth and Walnut Streets. Professor of Clinical Maxillo-Facial Surgery, University of Pennsylvania; Consultant in Maxillo-Facial Surgery, Walter Reed General Hospital, Washington, D. C.; Maxillo-Facial Surgeon to the Medico-Chirurgical and Polyclinic Hospitals; Visiting Oral Surgeon to the Philadelphia General Hospital.

* Denotes Non-resident.

1915. Jones, John F. X., B.S., A.B., M.D., 103 South Twenty-first Street. Instructor in Surgery, Jefferson Medical College; Surgeon to St. Joseph's Hospital, to the Misericordia Hospital, and to St. Agnes' Hospital.

1900. Jopson, John H., M.D., 1824 Pine Street. Visiting Surgeon to the Presbyterian Hospital, to the Children's Hospital, to the Medico-Chirurgical Hospital, to the Polyclinic Hospital, and to the Bryn Mawr Hospital; Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Associate in Surgery, Medical School, University of Pennsylvania; Consulting Surgeon to the Philadelphia Home for Incurables.

1914. Keene, Floyd Elwood, M.D., Medical Arts Building, Sixteenth and Walnut Streets. Associate in Gynæcology, University of Pennsylvania; Associate Professor of Gynæcology, Post Graduate School, University of Pennsylvania; Assistant Gynæcologist, University Hospital; Consulting Gynæcologist to the Abington Memorial Hospital.

1910. Kelly, James A., A.M., M.D., 1815 Spruce Street. Attending Surgeon to St. Mary's Hospital, to St. Joseph's Hospital, to Misericordia Hospital, and to Memorial Hospital, Roxborough; Associate Professor Post Graduate School, University of Pennsylvania.

1913. Klopp, Edward J., M.D., 1611 Spruce Street. Demonstrator of Clinical Surgery in the Jefferson Medical College; Assistant Surgeon to the Jefferson Hospital, to the Pennsylvania Hospital, and to the Germantown Hospital; Surgeon to Girard College.

1916. *Landon, L. H., M.D., F.A.C.S., 5074 Jenkins Arcade, Pittsburgh, Pa. Surgeon to Western Pennsylvania Hospital.

1914. Laws, George Malcolm, B.S., M.D., 2033 Locust Street. Associate in Surgery, University of Pennsylvania; Chief Surgeon, Outpatient Department, University Hospital; Assistant in Gynæcology, Presbyterian Hospital; Assistant Surgeon to the Philadelphia General Hospital, and to the American Stomach Hospital.

1895. LeConte, Robert G., A.B., M.D., 2000 Spruce Street. Surgeon to the Pennsylvania Hospital; Consulting Surgeon to the Germantown Hospital, and to the Bryn Mawr Hospital.

* Denotes Non-resident.

1910. LEE, WALTER ESTELL, M.D., F.A.C.S., 905 Pine Street. Associate Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Surgeon to the Germantown Hospital, and to the Children's Hospital; Assistant Surgeon to the Pennsylvania Hospital, and to the Bryn Mawr Hospital; Consulting Surgeon to the Henry Phipps Institute.

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

1900. MARTIN, EDWARD, A.M., M.D., LL.D., 135 S. Eighteenth Street. State Commissioner of Health; Professor of Surgical Physiology, University of Pennsylvania.

1919. MCKNIGHT, HOWARD ALLISON, A.B., M.D., 241 S. Thirteenth Street. Surgeon to St. Mary's Hospital; Assistant Professor of Surgery, Post Graduate School, University of Pennsylvania; Chief Surgeon to Out-patient Department, St. Mary's Hospital, Polyclinic Hospital, and the Medico-Chirurgical Hospital.

1917. MENCKE, J. BERNHARD, M.D., 1816 Spruce Street. Assistant Surgeon to the Out-patient Department of the Lankenau Hospital.

1915. MERRILL, WILLIAM JACKSON, A.B., M.D., 2017 Spruce Street. Orthopædic Surgeon to the Children's Hospital, and to the Germantown Hospital.

1907. MILLER, MORRIS BOOTH, M.D., 409 S. Twenty-second Street. Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Consulting Surgeon, Douglass Memorial Hospital.

1904. MITCHELL, CHARLES F., M.D., 332 S. Fifteenth Street. Surgeon to the Pennsylvania Hospital, to the Bryn Mawr Hospital, and to the Germantown Hospital.

1919. MONTGOMERY, EDWARD EMMET, B.S., M.D., Hon. A.M., LL.D., F.A.C.S., 1426 Spruce Street. Gynæcologist to Jefferson Hospital, and to St. Joseph's Hospital; Consulting Gynæcologist to the Jewish Hospital.

1906. MÜLLER, GEORGE P., M.D., B.S., 1930 Spuce Street. Professor of Surgery, Graduate School, University of Pennsylvania; Associate in Surgery, Medical School, University of Pennsylvania; Surgeon to the Misericordia Hospital, and to the St. Agnes' Hospital; Consulting Surgeon to the Chester County Hospital.

1902. MUTSCHLER, LOUIS, M.D., F.A.C.S., 1625 Spruce Street. Surgeon to the Episcopal Hospital; Associate Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1905. NASSAU, M.D., LL.D., F.A.C.S., 1710 Locust Street. Chief Surgeon to the Frankford Hospital; Surgeon to St Joseph's Hospital; Assistant Surgeon to Jefferson Hospital; Assistant Professor of Surgery, Jefferson Medical College; Consulting Surgeon to Pottstown Hospital, Pottstown, Pa.

1890. NEILSON, THOMAS RUNDLE, A.M., M.D., 1937 Chestnut Street. Surgeon to the Episcopal Hospital; Consulting Surgeon to St. Christopher's Hospital for Children; Professor of Genito-urinary Surgery in the University of Pennsylvania.

1906. *NORRIS, HENRY C., M.D., F.A.C.S., Rutherfordton, N. C. Surgeon to the Rutherfordton Hospital, Rutherfordton, N. C.

1917. NORRIS, RICHARD C., A.M., M.D., 500 N. Twentieth Street. Surgeon-in-charge, Preston Retreat; Assistant Professor of Obstetrics, Medical School, University of Pennsylvania; Professor of Obstetrics, University Post Graduate Medical School; Gynæcologist to the Methodist Hospital; Consulting Gynæcologist to the Norristown Insane Asylum; Consulting Obstetrician to the Germantown Hospital, to the Misericordia Hospital, and to the Philadelphia General Hospital.

1915. OWEN, HUBLEY RABORG, M.D., 319 S. Sixteenth Street. Instructor in Surgery, Jefferson Medical College; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases.

1912. PFEIFFER, DAMON BECKETT, A.B., M.D., 2028 Pine Street. Associate in Surgery, University of Pennsylvania; Assistant Surgeon, University of Pennsylvania Hospital; Surgeon to the Abington Memorial Hospital; Assistant Surgeon to the Presbyterian Hospital, and to the Out-patient Department of the Lankenau Hospital.

1919. PIPER, EDMUND B., B.S., M.D., F.A.C.S., 1936 Spruce Street. Associate in Obstetrics, Medical School, University of Pennsylvania; Assistant Professor of Obstetrics, Post Graduate School, University of Pennsylvania; Assistant Obstetrician to the University Hospital, and to the Presbyterian Hospital; Assistant Obstetrist and Gynæcologist to the Philadelphia General Hospital; Obstetrician to Maternity Hospital.

1916. RANDALL, ALEXANDER, B.A., M.A., M.D., F.A.C.S., Medical Arts Building, Sixteenth and Walnut Streets. Associate in Surgery, Medical School, University of Pennsylvania; Assistant Urologist, University Hospital, and Philadelphia General Hospital; Urologist to the Chestnut Hill Hospital; Consulting Surgeon to the Germantown Hospital.

* Denotes Non-resident.

1890. ROBERTS, JOHN B., A.M., M.D., 313 S. Seventeenth Street. Professor of Surgery, Graduate School of Medicine, University of Pennsylvania.

1898. ROBINSON, J. WEIR, M.D., 326 S. Sixteenth Street.

1913. RODMAN, JOHN STEWART, M.D., Medical Arts Building, Sixteenth and Walnut Streets. Associate Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Surgeon to the Polyclinic Hospital, and to the Medico-Chirurgical Hospital; Associate Surgeon to the Presbyterian Hospital, and to the Bryn Mawr Hospital.

1900. ROSS, GEORGE G., B.S., M.D., 1721 Spruce Street. Associate Surgeon to the University of Pennsylvania Hospital, and to the Lankenau Hospital; Surgeon to the Germantown Hospital, and to the Methodist Hospital; Associate in Surgery, University of Pennsylvania.

1913. RUGH, J. TORRANCE, A.B., M.D., Medical Arts Building, Sixteenth and Walnut Streets. Professor of Orthopædic Surgery, Jefferson Medical College; Clinical Professor of Orthopædic Surgery, Woman's Medical College of Pennsylvania; Orthopædic Surgeon to the Jefferson Hospital, to the Methodist Episcopal Hospital, to the Philadelphia General Hospital, to the Montgomery Hospital of Norristown, and to the North American Sanatorium of Atlantic City, N. J.; Consulting Orthopædic Surgeon to the Philadelphia Lying-in Charity Hospital, to the West Philadelphia Hospital for Women, to the Pennsylvania State Institution for Epileptic and Feeble-minded, Spring City, Pa., to the New Jersey State Institution for Feeble-minded and Epileptics, Vineland, N. J., and to the Pottstown Hospital, Pottstown.

1903. SITER, E. HOLLINGSWORTH, M.D., 1520 Locust Street. Visiting Genito-urinary Surgeon to the Philadelphia General Hospital; Associate in Genito-urinary Surgery, University of Pennsylvania; Surgeon-in-Charge Genito-urinary Clinic, University of Pennsylvania Hospital.

1894. SHOEMAKER, GEORGE ERETY, M.D., 1906 Chestnut Street. Gynæcologist to the Presbyterian Hospital, and to the Pennsylvania Epileptic Hospital and Colony Farm.

1913. SKILLERN, PENN-GASKELL, JR., M.D., F.A.C.S., 1523 Locust Street. Associate Professor of Surgery, Graduate School, University of Pennsylvania; Surgeon to the Polyclinic Hospital; Consulting Surgeon to the Douglass Hospital.

1909. SPEESE, JOHN, M.D., 2032 Locust Street. Associate Professor of Surgery, Graduate School, University of Pennsylvania; Assistant Professor of Surgical Pathology, University of Pennsylvania School of Medicine; Surgeon to the Presbyterian Hospital, and to the Children's Hospital.

1898. SPELLISSY, JOSEPH M., M.D., 317 S. Fifteenth Street. Visiting Surgeon to St. Joseph's Hospital, and to the Methodist Episcopal Hospital; Surgeon to St. Edmond's Home for Crippled Children.

1911. STELLWAGON, THOMAS C., JR., M.D., 1831 Chestnut Street. Chief Clinical Assistant in the Out-patient Surgical Department of the Jefferson Medical College Hospital.

1919. SWARTLEY, WILLIAM B., M.D., Pelham Court, Germantown. Assistant Surgeon to the Germantown Dispensary and Hospital; Dispensary Surgeon to the Germantown Dispensary and Hospital; Assistant Surgeon to the Philadelphia General Hospital; Assistant Demonstrator of Anatomy, Jefferson Medical College.

1908. SWEET, JOSHUA EDWIN, A.M., M.D., F.A.C.S., 301 St. Mark's Square. Professor of Surgical Research, University of Pennsylvania.

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

1911. THOMAS, B. A., M.D., 116 S. Nineteenth Street. Professor of Urology, Graduate School of Medicine, University of Pennsylvania; Genito-urinary Surgeon to the Presbyterian Hospital.

1911. THOMAS, THOMAS TURNER, 1905 Chestnut Street. Associate Professor of Applied Anatomy and Associate in Surgery in the University of Pennsylvania.

1915. THOMAS, W. HERSEY, M.D., Medical Arts Building, Sixteenth and Walnut Streets. Professor of Genito-urinary Surgery in Temple University; Genito-urinary Surgeon to Samaritan Hospital and to Garretson Hospital; Surgeon to the Eastern State Penitentiary.

1892. WHARTON, HENRY, A.M., M.D., 1725 Spruce Street. Consulting Surgeon to the Presbyterian Hospital; Surgeon, Emeritus, to the Children's Hospital and to the Girard College.

1902. WHITING, A.D., M.D., 1523 Spruce Street. Surgeon to the Germantown Hospital; Assistant Surgeon to the Lankenau Hospital; Medical Director at the Germantown Hospital; Associate in Surgery, University of Pennsylvania.

1919. WILLARD, DEFOREST, B.S., M.D., 1630 Spruce Street. Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Orthopædic Surgeon to the Polyclinic Hospital, to the Jewish Hospital, to the Delaware Hospital, to the Wilmington Hospital, to the Home of the Merciful Saviour, and to the North American Sanatorium; Assistant Orthopædic Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1898. WOOD, ALFRED CONARD, 2035 Walnut Streeet. Surgeon to the Hospital of the University of Pennsylvania, to the Philadelphia General Hospital, to the Howard Hospital, to the Memorial Hospital (Roxborough, Pa.), and to the Rush Hospital; Assistant Professor of Surgery to the University of Pennsylvania.

1902. YOUNG, JAMES K., M.D., 222 S. Sixteenth Street. Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Orthopædic Surgeon to the Polyclinic Hospital; Consulting Orthopædic Surgeon to the Women's Hospital of Philadelphia, to the Philadelphia Lying-in Charity; Visiting Chief on the Orthopædic Staff of the Philadelphia General Hospital.

LIST OF FELLOWS WHO HAVE DELIVERED THE ANNUAL ADDRESS

1881. S. D. GROSS.
1882. D. HAYES AGNEW.
1883. WILLIAM HUNT.
1884. JOHN H. BRINTON.
1885. JOHN H. PACKARD.
1886. R. J. LEVIS.
1887. J. EWING MEARS.
1888. C. B. G. DE NANCREDE.
1889. JOHN B. ROBERTS.
1890. DE FOREST WILLARD.
1891. WILLIAM G. PORTER.
1892. T. G. MORTON.
1893. C. W. DULLES.
1894. W. B. HOPKINS.
1895. JOHN B. DEAVER.
1896. JAMES M. BARTON.
1897. THOMAS R. NEILSON.
1898. O. H. ALLIS.
1899. WILLIAM J. TAYLOR.
1900. NONE.
1901. H. R. WHARTON.
1902. J. M. SPELLISSY.
1903. R. G. LECONTE.
1904. G. G. DAVIS.
1905. J. CHALMERS DACOSTA.
1906. RICHARD H. HARTE.
1907. EDWARD MARTIN.
1908. CHARLES H. FRAZIER.
1909. JOHN H. GIBBON.
1910. ASTLEY P. C. ASHHURST.
1911. JOHN H. JOPSON.
1912. GEORGE G. ROSS.
1913. WM. L. RODMAN.
1914. ALFRED C. WOOD.
1915. FRANCIS T. STEWART.
1916. EDWARD B. HODGE.
1917. J. EDWIN SWEET.
1918. NONE.
1919. NONE.
1920. JOHN G. CLARKE.
1921 J. TORRANCE RUGH

WINNERS OF THE SAMUEL D. GROSS PRIZE

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

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

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

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

1915 "Surgery in the Treatment of Hodgkin's Disease."—Dr. John Lawrence Yates, Milwaukee, Wis.

1920 "Some Fundamental Considerations in the Treatment of Empyema Thoracis."—Dr. Evarts A. Graham, St. Louis, Mo.

HONORARY FELLOWS

ELECTED.		DIED.
1881	Sir James Paget, London, England	December 30, 1899.
1881	Theodore Billroth, Vienna, Austria	January 5, 1894.
1881	Bernhard von Langenbeck, Berlin, Germany	September 30, 1887.
1881	Willard Parker, New York, N. Y.	April 25, 1884.
1881	Lewis A. Sayre, New York, N. Y.	1900 or 1901.
1881	Moses Gunn, Chicago, Illinois	November 4, 1887.
1881	John T. Hodgen, St. Louis, Mo.	April 28, 1882.
1881	W. W. Dawson, Cincinnati, Ohio	February 16, 1893.
1881	T. G. Richardson, New Orleans, La.	May 26, 1892.
1881	J. Collins Warren, Boston, Massachusetts.	
1881	W. T. Briggs, Nashville, Tennessee	June 13, 1894.
1881	Christopher Johnston, Baltimore, Md.	October 11, 1891.
1881	D. W. Yandell, Louisville, Ky.	May 2, 1898.
1898	Maurice H. Richardson, Boston, Mass.	July 31, 1912.
1898	George M. Sternberg, Washington, D. C.	November 3, 1915.
1898	Charles B. McBurney, New York, N. Y.	November 7, 1913.
1898	Nicholas Senn, Chicago, Illinois	January 2, 1908.
1898	Theodore Prewitt, St. Louis, Mo.	October 17, 1904.
1898	L. McLane Tiffany, Baltimore, Md.	October 23, 1916.
1898	Nathaniel P. Dandridge, Cincinnati, Ohio.	1911 or 1912.
1898	Roswell Park, Buffalo, N. Y.	February 15, 1914.
1898	Robert F. Weir, New York, N. Y.	
1898	Frederick S. Dennis, New York, N. Y.	

ELECTED.		DIED.
1900	W. H. A. Jacobson, London, England.	
1900	Theodore Kocher, Berne, Switzerland....	July 27, 1917.
1900	Vincenz Czerny, Heidelberg, Germany....	October 3, 1916.
1906	William J. Mayo, Rochester, Minn.	
1906	Dudley P. Allen, Cleveland, Ohio.....	January 6, 1915.
1906	Robert Abbe, New York, N. Y.	
1906	C. B. G. deNancrede, Ann Arbor, Mich....	May 6, 1921.
1907	John C. Munro, Boston, Mass.	December 6, 1910.
1908	J. Ewing Mears, Philadelphia, Pa.	May 28, 1919.
1909	Lewis Stephen Pilcher, Brooklyn, N. Y.	
1916	W. W. Keen, Philadelphia, Pa.	

FELLOWS OF THE ACADEMY WHO WERE IN THE WAR SERVICE

(This does not include the Fellows elected to the Academy after the termination of the War.)

Lieutenant-colonel Edward B. Hodge, M.C., U.S.A.
Lieutenant-colonel John H. Jopson, M.C., U.S.A.
Lieutenant-colonel Damon B. Pfeiffer, M.C., U.S.A.
Major John Speese, M.C., U.S.A.
Major J. Stewart Rodman, M.C., U.S.A.
Major Henry P. Brown, M.C., U.S.A.
Major George M. Laws, M.C., U.S.A.
Major William W. Keen, M.R.C., U.S.A.
Colonel Astley P. C. Ashhurst, M.C., U.S.A.
Lieutenant-colonel William J. Taylor, M.C., U.S.A.
Major DeForest P. Willard, M.C., U.S.A.
Major Walter Estell Lee, M.C., U.S.A.
Captain Hubley R. Owen, M.C., U.S.A.
Captain Edward T. Crossan, M.C., U.S.A.
Lieutenant-colonel E. Hollingsworth Siter, M.C., U.S.A.
Lieutenant-colonel Charles H. Frazier, M.C., U.S.A.
Major Henry C. Norris, M.C., U.S.A.
Lieutenant-colonel Emory G. Alexander, M.C., U.S.A.
Captain James H. Baldwin, M.C., U.S.A.
Commander George G. Ross, M.C., U.S.N.R.F.
Major Alexander Randall, M.C., U.S.A.
Captain Howard A. McKnight, M.C., U.S.A.
Major Charles F. Nassau, M.C., U.S.A.
Lieutenant-colonel J. B. Carnett, M.C., U.S.A.
Lieutenant-colonel Charles F. Mitchell, M.C., U.S.A.

Major G. M. Dorrance, M.C., U.S.A.

First Lieutenant William B. Swartley, M.C., U.S.A.

Captain Walter G. Elmer, M.C., U.S.A.

Major L. H. Landon, M.C., U.S.A.

Lieutenant-colonel J. E. Sweet, M.C., U.S.A.

Major W. Hersey Thomas, M.C., U.S.A.

Major George P. Müller, M.C., U.S.A.

Lieutenant-colonel Robert H. Ivy, M.C., U.S.A.

Lieutenant P. G. Skillern, Jr., M.C., U.S.N.R.F.

Lieutenant-colonel James T. Rugh, M.C., U.S.A.

Captain William Jackson Merrill, M.C., U.S.A.

Commander J. Chalmers DaCosta, M.C., U.S.A.

Major Harry S. Carmany, M.C., U.S.A.

Major Hiram R. Loux, M.C., U.S.A.

Lieutenant-colonel Richard H. Harte, M.C., U.S.A.

Colonel John H. Gibbon, M.C., U.S.A.

Lieutenant-colonel Edward Martin, M.C., U.S.A.

Major John B. Deaver, M.R.C., U.S.A.

Lieutenant B. A. Thomas, U.S.N.R.F.

Major Thomas C. Stellwagen, M.C., U.S.A.

Commander Morris Booth Miller, M.C., U.S.N.R.F.

Lieutenant John F. X. Jones, M.C., U.S.N.R.F.

Major Floyd E. Keene, M.C., U.S.A.

Commander Robert G. LeConte, M.C., U.S.N.R.F.

Major Edmund B. Piper, M.C., U.S.A.

CONTENTS

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING, HELD JANUARY 5, 1920

The President, Dr. George G. Ross, in the Chair

THREE-WEEKS-OLD EXTRA-UTERINE EMBRYO

Dr. Astley P. C. Ashhurst reported the case of a woman, aged twenty-six years, who was admitted to the Episcopal Hospital during the night of August 21, 1919, complaining of pain in the lower right quadrant of the abdomen. Her last menses, which began August 5, were normal. Eight days before admission (that is, August 13) she began to bleed again, and to suffer some abdominal pain. On admission she was thought by the receiving ward interne to have salpingitis, and she was sent to the ward over night. In the morning she appeared slightly anæmic, and a diagnosis of ruptured extra-uterine pregnancy (right) was made. The pain persisted, and there was a very tender mass in the region of the right tube.

On opening the abdomen the presence of free fresh blood confirmed the diagnosis; the right tube was distended and tense with blood, and bleeding from the fimbriated extremity continued. The tube and ovary (and, incidentally, the appendix) were removed, the blood evacuated, and the abdomen closed. Recovery was uneventful.

Section of the tube discloses an embryo (Fig. 1), apparently about three weeks only in age, lying lengthwise in the tube, in the midst of blood clot. The membranes were intact. Evidently tubal abortion was impending at the time of operation.

Dr. W. H. F. Addison, Professor of Histology and Embryology in the University of Pennsylvania, very kindly examined the specimen under the microscope, and reported its length as 10 mm. The cephalic extremity was somewhat crushed, but the limb buds could be detected; they showed no indication of any digitations, nor even club-shaped expansion of their ends. From these data he estimated its age at about thirty days.

SAC OF INDIRECT INGUINAL HERNIA WITH COMPLETE OBLITERATION AT ONE POINT

Doctor Ashhurst also reported the case of a man, aged twenty-six years, who wore a truss for about eighteen months, when a small boy, for right inguinal hernia. Since childhood the hernia had not been down

until it appeared as an incomplete indirect right inguinal hernia, after a lifting strain a few days before operation, which was done January 2, 1920, at the Episcopal Hospital. The sac extended below the level of the external ring, and its fundus was distinct from the tunica vaginalis testis. When the sac was opened near its fundus, it was found obliterated about 4 cm. distal to the internal ring. The proximal portion of the sac, continuous with the peritoneal cavity, was then opened, and both portions of the bilocular sac excised; and the inguinal canal was repaired in the usual way (after incidental appendectomy through a McBurney incision).

Doctor Ashhurst remarked that one knows how frequent it is to meet with partial occlusions of such hernial sacs, at one or more levels; and the occurrence of hydrocele of the cord proves that complete obliteration may occur. But the question is, does wearing a truss for eighteen months, or even for eighteen years, produce such an obliteration? It seems very unlikely that it ever does; certainly nothing he had ever encountered in an operation for inguinal hernia indicates that it does; and even granting that this case is an instance of the occurrence, the fact remains that the obliteration occurred not *at the internal ring,* where it might prevent recurrence of the hernia, but in the course of the sac as it passed through the canal, and that the hernia did recur in the proximal portion of the sac.

ABNORMAL DRAINAGE FOLLOWING CHOLECYSTOSTOMY

Dr. Edward B. Hodge reported the case of a woman, a patient of Dr. A. B. Gill, who was admitted to the Presbyterian Hospital July 12, 1916, with history of removal by Doctor Gill of a subacute appendix four years before. For the past ten months there had been attacks of pain in the epigastrium, radiating into the back and right shoulder at times, nausea, vomiting, and epigastric tenderness. When seen a week before, there was slight jaundice. No fever in this or previous attacks. A diagnosis of cholecystitis had been made and operation decided on when jaundice subsided. Although this was still present, pain was so severe as to demand relief.

Under gas-ether an enlarged, rather thick-walled gall-bladder was exposed. It was adherent to the omentum. Stones were felt in the gall-bladder but not in the common duct. The foramen of Winslow was open. The gland at the junction of the cystic and common ducts was enlarged as also the pancreas. The stomach and duodenum were normal. Difficulty in relaxing the patient prevented good exposure, so drainage rather than removal of the gall-bladder was done. There were many dark green stones and the mucous membrane was moderately inflamed, but not of the " strawberry " type. A tube was placed in the gall-bladder and a cigarette drain to the kidney pouch.

For forty-eight hours she did well. In the first twenty-four hours there was drainage of more than a pint of bloody mucus and bile, later

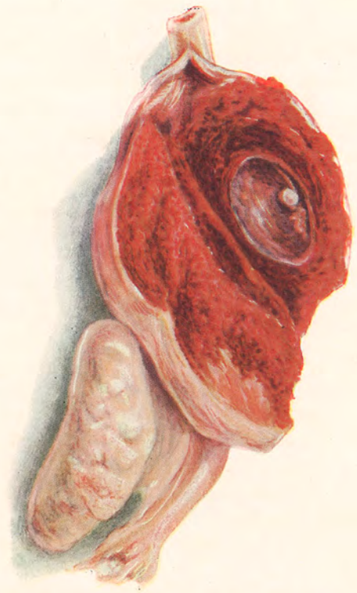

Fig. 1.—Very early extra-uterine pregnancy (three weeks). Embryo lying in a mass of blood clots in the tube—actual size.

becoming green. For the first fifteen hours of the second twenty-four there was no drainage. On the evening of this day, the fourteenth, drainage became free again, and by evening of the fifteenth amounted to 70 ounces (2100 c.c.) of turbid fluid with some flakes in it. Temperature was 100°, abdomen soft, passing flatus, stomach a little unsettled, and pulse weaker and 120. She was beginning to feel very weak and prostrated. The weather was extremely hot.

From this evening to the next morning the amount of drainage was 1050 c.c. of the same character. Her condition was now alarming with small weak pulse, extremities cold, clammy and bluish, face yellowish, but lips a good color, breath not bad, and no acetone in urine which had become very scant in the last twenty-four hours. Stimulation was increased and saline given under skin in addition to the glucose-sodium bicarbonate solution that had been used by rectum. At this time Doctor Jopson saw her in consultation. The question of attempting to check the excessive drainage from the gall-bladder was discussed, since her condition seemed to be largely due to great loss of fluid by this channel. A clamp was placed on the tube and from that time no fluid came from or around the tube.

By the next morning the patient's condition was decidedly improved, she had had a restful night and felt better. She had passed only 6 ounces of urine in the last twenty-four hours, but this was entirely negative The tube was removed four days later and replaced by a gauze strip. There was thereafter no leakage. She was discharged from hospital two weeks from operation and has remained in excellent health since.

Colon bacillus was cultured from the gall-bladder at operation. The laboratory report on the yellowish, turbid, flaky fluid at the time of the greatest amount of drainage showed unexpected findings. Tests for bile acids and bile were negative. The fluid did not digest egg albumin or starch and therefore contained no pancreatic ferment. Quantity not sufficient for lipose test.

It is readily seen that the unusual features in this case are the amount and the source of the drainage. The amount of discharge, if from the liver, far exceeded anything he had found recorded in the literature or in the experience of those with whom he had discussed it. The normal daily production of bile is usually given as from 700–900 c.c. In this case there was once 2100 c.c. and again 1020 c.c. for some fifteen hours.

In the absence of positive findings for bile and bile acids, we are led to seek other possible sources. There was no evidence at operation of communication between gall-bladder and stomach, duodenum or colon. Nor was there any reason for post-operative development of such communication. Back flow from the duodenum through a relaxation of the common duct sphincter also seemed ruled out by the laboratory findings. Of one thing we can be sure—the drainage came through a tube sutured into the gall-bladder. In the reporter's opinion the drainage had its

origin in the liver, even though for some reason the ordinary tests for bile were not positive.

ANHYDROUS COCAINE SPINAL ANÆSTHESIA

Dr. James Ralston Wells read a paper with the above title, for which see page 6.

ULCERATIVE CYSTITIS

Dr. Floyd E. Keene read a paper entitled "Circumscribed Pan-mural Ulcerative Cystitis," for which see page 14.

Dr. John G. Clark paid a tribute to Dr. Guy Hunner for having discovered and brought this unique pathologic entity to our knowledge. As the report of these cases from the Gynæcological Department of the University Hospital will show, they have all been of chronic standing and the patients have suffered in many instances so excessively that they have become chronic invalids, the dysuria and frequency of urination being so great as practically to confine them to their homes. All surgeons in years past have persistently treated cases of this type under the diagnosis of chronic cystitis, and yet neither the cystoscopic picture nor the urinalysis bore out this diagnosis. The case that brought this type of pathology to his cognizance was the first one to which Doctor Keene alluded, of a woman who had been under observation for fifteen years for an extensive cystitis following an abdominal operation. Gradually all of the characteristic clinical findings of cystitis disappeared but the symptoms persisted and even grew worse. After several ineffectual operations of various types and the employment of every manner of treatment the patient fell into Doctor Hunner's hands, who promptly made a diagnosis of solitary ulcer, and, after she had undergone the operation which he has devised for this condition, she regained her health completely.

These cases in their variation between acute exacerbations and temporary quiescence are suggestive of the manifestations of a duodenal ulcer. Also, the symptoms are out of all proportion to the diminutive lesion which one discovers on cystoscopic examination. The lesion, therefore, is an extremely small one, but the symptoms are decidedly major in severity. When one views these small ulcers and contemplates the major operation necessary to relieve the patient the therapeutic procedure unquestionably appears to be out of proportion to the existing pathology. Nevertheless, as the results have demonstrated, there is no series of patients more grateful for their relief than these, and count the operation of small significance when they have experienced complete relief. It is to be hoped that the time will come when some other form of treatment may be instituted which may obviate so extensive an operation. Nevertheless, Hunner has given these cases the most painstaking and skilful attention, and finally through failure of local treatment to achieve favorable results, he was compelled to resort to operation. In view of

the fact that Hunner has so well defined and described this condition, there need be no great difficulty in naming the condition. We have chosen, therefore, to designate this as the Hunner Ulcer, for we feel that through his careful work he deserves this identification.

Dr. Alexander Randall said that since his attention had been drawn by Doctor Keene to this type of bladder ulcer he had been looking for it in the male, but had not thus far met with it. He had asked Doctor Keene as to the possibility of the condition being tuberculosis. The ulceration of the bladder, the sterile urine cultures, and the chronicity highly suggest tuberculous origin. He replies that in repeated examinations cultures in guinea pigs have been negative as well as studies of section of excised tissue. He cannot, however, help feeling that search should be continued along this line, because as pointed out by Pelouse there has been observed another unusual form of tuberculosis in this region. Surgeons are still very much in ignorance of the actual pathology and physiology of the bladder itself, especially as regards infections.

MALIGNANT DISEASE OF THE LUNGS

Dr. George E. Pfahler read a paper with the above title, for which see page 21. The paper was illustrated by lantern slides.

ANHYDROUS COCAINE SPINAL ANÆSTHESIA*

By James Ralston Wells, M.D.
of Philadelphia, Pa.

Before arriving at the exact title matter of this address, let us briefly review the subject of spinal anæsthesia or analgesia (because by this means of insensibilitation the protopathic sense is subdued before the epicritic, motor, or muscular senses). In 1885, Corning, of New York, attempted the first work on the spine to produce analgesia. For this he used cocaine, but did not enter the spinal theca. Quincke, in 1891, introduced the lumbar puncture, but it remained for Bier,[1] in 1898, to first perform a lumbar puncture for analgesic purposes. Using cocaine as his agent, himself, his assistant, and six patients as subjects, were given the initial doses. His results were most discouraging, all eight subjects had severe vertigo, vomiting, and headache. In 1900, Tuffier,[2] of Paris, reported 80 cases, cocaine used, with good results and no deaths. Reclus[3] reports six deaths with cocaine. In 1902, Perkins[4] reports 2345 cases and 16 deaths. In 1891, Giesel isolated tropococaine, Chadbourne named it a year later, then followed stovaine (Tourneau in 1904), and novocaine (Einhorn, 1904).

To continue, in 1905, Morton[5] reported 2066 cases, 1427 of which with cocaine, the balance with tropococaine, no deaths. Bier[6] reported 305 cases with no serious results. In 1908, Sonnenburg, Kunnel, and Allesardri collectively, have reports numbering 3235 cases with 3 deaths, while Bruning reports 3 deaths in 450 cases. Barker,[7] in 1908, in his first series of about 300 cases reports .6 per cent. mortality, while in a subsequent series of 475 cases no deaths occurred. Strauss,[8] in 1909, collects a series of 22,717 with 7 deaths; Houghton 735 cases, no deaths; McGavin, 844 cases, no deaths; therefore, in this series from 1908 to 1914 of about 28,746 cases, the mortality is not over 1 in 1200. The Ryall[9] statistics (1911) report a general mortality of 1 in 13,000. Babcock[10] (1915) reports 1295 cases, no deaths. Yount,[11] in 1917, reports 5160 cases, 1 death; Jonnesco, 10,000, no deaths (1915–1917 mortality 1 in 16,000).

With this array of figures, some of which may have been reduplicated, and many more omitted or not recorded, we may draw the conclusion that spinal anæsthesia is gaining in popularity and losing in mortality. Is it a sky-rocket bursting brilliant, then falling, as it was spoken of by Wm. M. Perkins in 1902, or is it reaching its logical, useful level among our anæsthetics?

* Read before the Philadelphia Academy of Surgery, January 5, 1920.

That it has a definite place in surgery is becoming a fact. More exact knowledge of the general underlying principles involved will lead to results more near perfection. The death-rate varies with the different reports and at best no exact rate can be ascertained, because different surgeons in attributing death to anæsthetics include deaths in cases of advanced toxæmia and poor surgical risks, while others exclude them. The mortality may also be based on a series of one year's cases and referring to one drug only, while others cover a number of years, including from the earliest use of cocaine in its impure form, up to the most advanced technic and perfect isolation of the pure drug used. So one may report three deaths in three cases, while another may report thousands and no deaths, and all gradations between. Another point. While immediate operative mortality of spinal anæsthesia is higher than that of ether, the additional mortality from post-operative complications following ether narcosis would probably about balance them.[14]

Spinal analgesia may be condemned as dangerous, and it is not without danger, but in any case where a general anæsthesia is contraindicated, the use of any anæsthetic is a risk, as, for instance, in advanced peritonitis or strangulated hernia, in advanced cardiac or renal disease, in which many surgeons will advocate spinal analgesia. Why? Because they think there is less danger of death immediate or post-operative. Is this a fair trial for spinal anæsthesia? If it is *less* dangerous in these cases, why would it be more dangerous in the general run of surgical conditions where the chronic heart, kidney, or advanced toxæmia is not present?[12] There is no post-operative mortality nor delayed toxic state due to spinal anæsthesia (Sanders[13]).

We all have seen the picture of an acute abdomen, the set, anxious face of severe suffering, the distended, rigid abdomen, the rapid, bounding pulse, increased respiratory rate, and a pyrexia of possibly alarming proportions; to those who have never seen a case of this kind under spinal analgesia, to see the expression of pain practically gone, the rigid muscles relaxed, the general attitude of tranquillity supervene, is a revelation and one never to be forgotten, one that makes us think, whether it is wise to always subject such a patient to ether anæsthesia with its accompanying phenomena, the initial twenty to thirty minute struggle accentuating all conditions that we wish to avoid, *i.e.*, the congested flushed face, rapid respirations, hot moist skin, coughing and outpouring of mucus, a picture of stimulation and irritation.

In spinal analgesia we have a corresponding fall in diastolic and systolic pressure due to more or less paralysis of: (1) The bulbar centres. (2) Efferent vasomotor fibres which run in the lateral columns of the cord. (3) The vasomotor fibres which pass out with the anterior roots of the cord from the fifth dorsal to third lumbar segments.[15] Slow, shallow respirations, *reduced* pulse *rate*, thus a slower working heart against less resistance, skin pale, little or no moisture, muscles perfectly relaxed;

in short, a picture of rest, corresponding to sleep. These phenomena reach their height in from ten to thirty minutes, depending on the agent, amount, and strength used, and then gradually return to normal, mayhap before the operation is completed, and almost always before the protopathic sense returns.

After our initial stage of *stimulation* of ether anæsthesia, we *must* have a stage of more or less exhaustion. The patient no longer responds to ether stimula and we have the picture of a physically tired being, a drenched skin, lowered temperature, and we know in a short time the exhaustive vomiting will ensue which loses fluid, uses energy, adds to pain, and may possibly derange the operation in whole or in part.

All centripetal nerve impulses from the operative site being blocked in spinal analgesia at the posterior nerve roots, lessens that shock caused by trauma to viscera or raw tissues, that shock that is not controlled in general anæsthesia; also trauma *per se* is lessened due to the extreme flaccidity of the muscles, and in abdominal operations, in addition, the loss of the tendency of the intestines to protrude into the wound. Our patient is normal, additional shock is blocked, and the original shock is not added to, at least, and if a preliminary hypodermic of morphine or scopolamine, or both, had been given, we have a partial blocking of psychic phenomena. Rarely is there post-operative vomiting and a small proportion complain of headache for a day or so.

We may sum up the advantages: (1) Perfect analgesia. (2) Perfect muscular relaxation. (3) Absence of post-operative shock. (4) Absence of post-operative gastric disturbance. (5) Absence of post-operative motor restlessness, so often difficult to control in ether narcosis. (6) Retention of consciousness, thus allowing of deciding a point, as, for example, removal of two ovaries instead of one, as intended, also allowing of drug administration, coffee, etc., by mouth. (7) Immediate resumption of gastro-intestinal activity if operative conditions permit.

Added to these: The extreme ease of retraction of muscles. The loss of intestinal tendency to crowd the operative field. The relief in spastic or paralytic ileus, at times removing the operative necessity entirely. (Babcock reports several cases of this kind.) The saving of one pair of hands for other purposes in the operating room. The small space necessary for the agent and paraphernalia, and the relative cheapness as compared to ether, etc.

In enumerating the disadvantages: (1) The retention of consciousness may also be classed here, for example, in a highly neurotic individual. (2) Manipulation of the stomach and intestines. This at times gives rise to a "sinking" sensation, which, in turn, causes untoward psychic conditions, but these are rarely dangerous to life. (3) After a given amount of the analgesic agent is injected it cannot be readily controlled. Theoretically a tap in the lumbar region will drain off the cerebrospinal fluid containing the drug, and as the ependyma (choroid plexuses) of the

cerebral ventricles produces the fluid rapidly, the cord and nerve roots may be washed from above down by this means.[16] (4) Ether or one of the general anæsthetics can be obtained in almost any place, and its administration in the majority of cases is not difficult; on the other hand, a spinal analgesic agent is neither obtainable in all places nor is its administration so simple. (5) Failure of analgesia is variously reported as from 4 per cent. to 9 per cent., due in most part probably to non-entrance, wholly or in part, into the subarachnoid space; it may also be due in part to an inert agent. This per cent. includes complete or partial failures, unilateral and delayed analgesia.

The indications and contraindications vary with different surgeons, their drug agent, technic, and experience. We may safely say the following lists agree with the majority of those who have had a sufficient number of cases to be capable of judging.

Spinal analgesia is indicated in: (1) Cardiac conditions, alone or plus broken compensation. (2) Renal conditions, especially in the presence of impending uræmia. (3) Pulmonary conditions other than (*a*) acute febrile tuberculosis; (*b*) large pulmonary effusions; (*c*) *large* intra-thoracic growths. (4) Inguinal, femoral, and ventral hernias. (5) Shock, if blood-pressure is not too low or falling, especially in railroad accidents to legs or pelvis, and severe burns or scalds. (6) Acute abdominal conditions, including appendicitis with or without peritonitis, peritonitis, intestinal obstruction, and paralytic obstruction. (7) Reductions of dislocations. (8) Operations on anal region, urethra, bladder, prostate, uterus, and appendages. (9) Plethora, atheroma, and chronic alcoholics. (10) Lastly, the large class we all know, the stat case who has developed an acute operative condition within a short time after the ingestion of a full meal.

Of the contraindications, let us mention: (1) Subject with lowered blood-pressure (hypotension). (2) Turbid spinal fluid. (3) Diseases or tumors of the brain, cord, and meninges. (4) Recent syphilis. (5) Intra-thoracic conditions, as (*a*) very large effusions; (*b*) *large* growths, especially mediastinal. (6) Advanced toxic or moribund cases of peritonitis. (7) Acute febrile infections, especially acute pulmonary tuberculosis. (8) General sepsis or suppuration near the point of spinal puncture. (9) Finally, where patient cannot stay in bed for twenty-four hours after operation.

If some one drug and some one technic that answered all requirements were found, the ideal state would be reached. The ideal is always our aim, in everything progress is made because the ideal has not been reached, thus our research, our experiments, and our discoveries. Cocaine as a spinal analgesic was found in the broad, main principles, good, but dangerous (1898). Then followed tropococaine, stovaine, novocaine, alypin, syncaïne, each possessing qualities of perfection, each having the broad good principle of analgesia, but each falling short of the perfect, and so we bear them in mind, but still hunt for the more nearly perfect agent. Up until this time we have been rather limited in the operative

field, few surgeons operating above the costal border, rarely above the nipple line. Various agents in combination have been tried. Barker advocates a specific gravity heavier than spinal fluid; Babcock especially a lighter, although he uses a heavier also. Jonnesco combines strychnine, others use chloretone as a solvent, still others, sterile salt solution, and so on.

As to technic, many use Quincke's point, others Tuffier's point, still others, notably Babcock and Jonnesco, have injected opposite the segment supplying the part to be operated. The position of the patient is taken into account, heavier or lighter fluid in the spinal canal may rise or fall, as the case may be, when the patient sits up, lies on one side, prone or in Trendelenburg position. And other variations can be noted in looking over the various methods of administration that have been advocated. The method of having a drug pure, uncombined, and dry, being dissolved in the subject's own spinal fluid immediately before injection, has been mentioned in reports, but has never found the general favor as have the prepared sterile ampules of fluid.

To Dr. Paul Delmas, of the University of Montpellier, France, Chirurgien Consultant Régional of the XVI region, a surgeon active in front war surgery, as well as base hospital work, my friend and teacher, I owe the majority of the following matter in this paper. I will, with his permission, quote liberally from his manuscript copy of a report which he gave me in the spring of 1919.

Quoting: "The greater part of spinal anæsthesia has been confined to a variable upper limit of actual analgesia not ascending perfectly much above the umbilicus. To the work of Lefilliatre by the demonstration of many thousands of cases, we owe this sphere broadened to include the whole body, with a certainty and without risk, by the simple preliminary subtraction of spinal fluid. The height of the analgesia is the function of the fluid withdrawn. The diffusion of the active principle which has produced it, mounts higher in proportion as the resistance is less, which is opposed to its penetration by the volume of the superimposed liquid. As this pressure to be overcome increased with the elevation, any dose whatever obtained a duration so much the more brief with the higher the elevation, or inversely to the anæsthenization of the higher parts, requiring progressively increasing doses."

During the progress of the war, Doctor Delmas employed the procedure of Lefilliatre. Added experience and study led him to modify the technic so as to attain unity of dose with unity of time, whatever might be the height desired.

Instrumentation.—Spinal puncture needle (trocar and cannula), all glass syringe, Luer type, 20 c.c. Needle preferably of platinum-iridium, 7 cm. long, 1.4 mm. diameter, model of Bruneau, the point brought to an abrupt bevel.

Anæsthetic Agent.—"Purified hydrochlorate of cocaine," prepared by

Templier, Paris, or by an anhydrous process explained later in this paper. "This cocaine used to the exclusion of all other substitutes which are less active and less diffusible, hence necessitating stronger doses." Cocaine crystallized, dry, put up in sterile ampules, dissolved at the moment of use in the cerebrospinal fluid of the patient. "Solutions prepared in advance, by reason of molecular action observed, renders them promptly unreliable and injurious, the same is applicable to sterilization, heat altering the physiologic activity of the product."

"The lumbar puncture is performed at a level just above the sacrum" (between the fourth and fifth lumbar vertebræ. Tuffier's point). The syringe takes in 20–25 c.c. of fluid, is detached from the needle (trocar being inserted), and the first 20 c.c. thrown away, to have access with a certainty to the higher spaces. The ampule of cocaine, dry crystals to the dose desired (.01–.05 gm.), is opened, the remaining spinal fluid, 3–5 c.c., is put into the ampule and the whole gently agitated. The barrel of the syringe is charged with the freshly prepared cocaine solution, readjusted to the needle, 20 c.c. of new spinal fluid is drawn into the syringe, the whole is thrown forcibly back into the subarachnoid space. The force used is in proportion to the height desired (the higher the more force necessary). "This fluid column of analgesic liquid immediately diffuses in a homogeneous fashion into the remaining spinal fluid which impregnates to the same degree all the posterior roots." The reason of this is that "to the preliminary hypotension created by removing 20 c.c. of spinal fluid, there is added the force of penetration of a relatively large charged mass (over one-third of the remainder)."* All parts, needle-syringe joint, barrel, and plunger of syringe must fit tight, allowing of no leakage whatsoever.

The analgesia of the entire body is instantaneous if maximum force is used. "The other manifestations of sensibility, contact, and temperature, are not necessarily disturbed, conduction of pain alone is interrupted totally independent of the elevation. Duration of .01 gm. equals a minimum of fifteen minutes, this is often exceeded." The quality of analgesia is not altered by size of dose of agent, .01 gm. giving as perfect a result for fifteen minutes as .04 gm. for one to one and a half hours. "The action seems to be confined practically to the posterior ganglions alone, voluntary or reflex action is apparently undiminished. Ideation, circulation, and respiration are little, if any, slower than normal." Blood-pressure is possibly lowered, but not to a dangerous degree. No exact data as to this important condition have been made.

Doctor Delmas reports 431 cases by this agent, the results being: No failures, no mortality, immediate or following, due to analgesia, not even any alarm on the table. After effects, if any, have been very slight and transient. Doctor Delmas ends his report with: "So the procedure is to be employed above all in cases which contraindicate a general anæs-

* The amount of spinal fluid in a normal individual is about 70 c.c. Later findings place the amount from 125 c.c. to 150 c.c. Dercum, F. X., Dec. 8, 1919.

thesia, such as those suffering from shock, hemorrhagic, pulmonary, cardiac, albuminuric, diabetic conditions, and in general, all those who are doubtful risks."

"It is contraindicated in local sepsis at point of puncture, general cerebral tumors, fragile vasculatory systems in which one fears an intracephalic lesion."

I might add the sterilization of the puncture site is tincture of iodine one-half strength, two coats. Area includes from posterior inferior spine to posterior inferior spine, and from below the upper level of the sacrum to the first lumbar vertebra.

The method of purifying the cocaine has been carried out by Professor Gardin, of the University of Montpellier, together with Doctor Delmas. It consists of dissolving a given quantity of commercial hydrochlorate of cocaine in a given amount of absolute alcohol, recrystallizing by the addition of absolute water-free ether (sulphuric); decanting off the liquid, drying the crystals in a vacuum or a sulphuric chamber. Collecting, weighing, and putting crystals in ampules under sterile conditions. Glass of ampules should be colored preferably brown, size approximately 5 c.c.

In conclusion, my own experience with this anhydrous preparation of cocaine has been one bearing out Doctor Delmas in practically all particulars. The operative range of this analgesia includes operations on the forearm, glands of the neck, wounds of the scalp, and even a trephine. For resection of a rib in empyema or war wounds, it is apparently ideal. Post-operative headache is sometimes complained of, but not for long nor is it excessive in severity. There is no tingling or burning of the feet or legs as at times is met with in, for example, novocaine or syncaine, which agents I have observed used in several of the French clinics.

The posture when injection is made can be either sitting or lying, apparently there is no difference in result, the sitting posture is the more easy of injection. The analgesia is practically instantaneous. The toxicity has not been, to my knowledge, up to this time, worked out for this preparation of cocaine, but in a later report I hope to be able to present this phase.

A spinal analgesic is not an anæsthetic to abolish ether or even to supplant it, but is a very valuable aid to our anæsthetic series, and one, when ether is contraindicated, which may lessen our general surgical mortality.

I should like to add that to import this preparation of cocaine from France has been thus far impossible, but through the kindness and co-operation of Dr. George W. Raiziss it has been produced in the Dermatological Research Laboratory, Philadelphia, according to the original French formula.

REFERENCES

[1] Allen, J. M.: Vermont M. J., 1912, pl.
[2] Morrison, J. T. J.: Birmingham Med. Rev., 1913, lxxiv, 53–84.
[3] Reclus, P., Jr.: A. M. A., 1901, p. 1058.

[4] Perkins, Wm. M.: New Orl. M. and S. J., 1902, p. 139.
[5] Morton, A. W.: Northwestern Lancet, 1905.
[6] Bier, A.: Archiv. für k. Churg., lxxvii, p. 198.
[7] Sanders, T. L.: S. Afric. M. Rec., Capetown, 1914, xii, pp. 314–317.
[8] Strauss: Yearbook of Surgery, vol. ii, 1909, p. 27.
[9] Briggs, J. E.: N. Eng. M. Gaz., Boston, 1914, xlix, pp. 117–125.
[10] Babcock, W. W.: M. Red. N. Y., 1915, lxxxvii, p. 288.
[11] Yount, C. C.: S., G. and Obstet., Chicago, 1917, xxv, p. 4045.
[12] Mereness, H. E., Jr.: Am. Surg., Phila., 1913, lviii, pp. 47–55.
[13] Sanders, T. L.: S. Afric. M. Rec., Capetown, 1914, xii, p. 314–317.
[14] Boyd, A. S., and Young, C. C.: J. A. M. A., 1917, lxvii, pp. 601–604.
[15] Howell: Am. Textbook of Physiology, vol. I.
[16] McGavin: Clin. J., London, 1914, pp. 168–172.

CIRCUMSCRIBED PAN-MURAL ULCERATIVE CYSTITIS*

By Floyd E. Keene, M.D.
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In 1914 Hunner presented his first report of eight cases of a rare type of bladder ulcer in women (Hunner, G. L.: *Tr. South. Surg. and Gynec. Assoc.*, 1914, 27; *Boston Med. and Surg. Jour.*, 1915, 172, 660). He has subsequently reported seventeen additional cases under the title of "Elusive Ulcer of the Bladder" (Hunner, G. L.: 1918, *Amer. Jour. of Obstet. and Diseases of Women and Children,* lxxviii, No. 3). During the past three years, ten such cases have been treated on Dr. John G. Clark's service at the University Hospital and this paper is based upon our findings in these patients.

While this type of lesion is undoubtedly rare, we are confident that it is often overlooked not only because of failure to make a careful inspection of every portion of the bladder, but also to lack of proper interpretation of the findings which in the earlier cases may show very little variation from the normal so far as gross changes are concerned. In looking back over our own experience in cystoscopic work, we recall cases that were doubtless of this type, in which the condition was overlooked completely, or, recognizing it, we failed to direct appropriate treatment for its cure.

This error was forcibly impressed upon us by a case, long under our care, who finally consulted and was operated upon by Doctor Hunner; at operation he demonstrated, without question, the extent of disease and the complete cure in this case left no doubt as to the wisdom of his teaching regarding the value of excision.

Hunner has described the condition under the name of "Elusive Ulcer," choosing the term to designate the difficulty often experienced in locating the ulcer. Such a nomenclature seems unsatisfactory in that it gives no conception of the pathology and, in fact, may be misleading in that it magnifies the importance of the ulcer which in reality is a small part and but an end result of an inflammation involving a considerable portion of the entire bladder wall. The lesion brings to mind a type of disease which Nitze calls Cystitis Parenchymatosa (Knorr: *Die Cystoskopie und Urethroskopie beim Weibe,* p. 211), in which not only the mucosa but the submucosa and muscularis participate, and until recently we have spoken of the lesion we are about to describe as a circumscribed parenchymatous ulcerative cystitis. Dr. Allen J. Smith has suggested

*From the Department of Gynæcology, University of Pennsylvania. Read before the Philadelphia Academy of Surgery, January 5, 1920.

that the word "pan-mural" be substituted for "parenchymatous," pointing out the fact that the former is more accurate in its application to the pathology of the bladder as well as more descriptive of the extent of the inflammation, and we have followed his suggestion.

Pathology.[1]—Grossly, the lesion is characterized by more or less thickening of the entire bladder wall with œdema and minute, superficial ulceration of the mucosa. The disease is practically always limited to the vertex of the bladder, although rarely it may extend downward and laterally on one or both sides to within a few centimetres of the trigone. The amount of bladder wall involved varies considerably; of our operative cases, the tissue removed ranged from 2 by 3 centimetres to 7 by 7 centimetres. The disease is never "patchy" in distribution, but is limited to one section of the bladder. The bladder wall is distinctly firmer than normal and in two of our cases the induration could be detected on bimanual examination. The inflammation may extend beyond the bladder confines, not infrequently involving the paravesical tissues and adjacent peritoneum. Such a paracystitis is most commonly found in association with and in the immediate vicinity of a comparatively large ulcer.

The mucosa is thickened and œdematous and with proper illumination the diseased area stands out in sharp contrast with the normal bladder. The ulcers may be single or multiple; in our series the latter has occurred more commonly, but in no case have we found more than three. The areas of ulceration are always minute and very superficial; because of this one may at first glance have difficulty in locating them. The ulcer usually presents a clean, bright red surface with sharply cut edges. The lightest touch with a cotton-covered probe will be followed immediately by bleeding.

Microscopically, the picture is that of an inflammation involving the entire bladder wall and paravesical tissues. The bladder wall is thickened, due in small part to fibrous tissue, but largely to loosening of the intermuscular and paravesical connective tissue incident to œdema. Within the areas of ulceration, the inner surface of the mucosa fails to show the presence of the ordinary epithelium; the basement membrane is, as a rule, well marked and is often somewhat thickened. Immediately beneath the basement membrane in the non-ulcerated portions are areas of dense round-cell infiltration, consisting mainly of lymphocytes and plasma cells. Where there is loss of the surface epithelium, the fibrous tissue is very loose and is filled with polymorphonuclear leucocytes.

The deeper part of the submucosa may be fairly free from an inflammatory exudate and shows little change save loosening from œdema, but its blood-vessels often stand out prominently, due to the number of polymorphonuclear leucocytes which are seen not only within the lumen,

[1] I am greatly indebted to Dr. Allen J. Smith and Dr. Charles C. Norris for their interest and assistance in the study of these sections.

but infiltrating the vessel walls and perivascular tissues. Here mononuclear cells are fairly rare, only an occasional large mononuclear being seen.

The same vascular and perivascular polynuclear invasion affects the blood-vessels in the muscular and outer coat, being often very marked in the latter, so that a leucocytic thrombus is in many instances apparent, and the leucocytic involvement of the coats is such that one would speak of an acute exudative arteritis and phlebitis. The appearance is given that the lymph channels are similarly affected. Foci of round-cell infiltration likewise occur in the muscle fascicles, but no degenerative changes have been observed.

Cystoscopic Picture.—The picture presented by the cystoscope (Fig. 1) is fairly typical in most cases, and having seen one or more, the observer is immediately aware of the fact that he is in all probability dealing with an ulcer-bearing area. The most striking feature is œdema of the mucosa, localized in the vertex of the bladder. The œdematous area is somewhat hazy, there is an absence of sharp definition of the vessels, or the vessels may appear unduly short, seeming to suddenly appear in the field, and after a short distance, completely disappear from view. Or they may be seen in small clusters, giving a "flea-bite" appearance in one or more areas.

The mucosa has lost its normal golden-white, glistening surface, and has assumed a more or less diffuse, dull pink color. Occasionally one sees elongated, elevated areas of mucosa which give the appearance of scar tissue, and in one of our cases two small ulcers were mounted at the summit of such an area. With a well distended bladder and good illumination, one can make out very clearly the sharp line of demarcation between the normal and œdematous mucosa.

The ulcers give the appearance of minute areas of healthy granulation tissue, the base being a deep red color and rarely covered with fibrin. Through the cystoscope the ulcers stand out even more plainly than with the naked eye; they present sharply cut edges and are always superficial, appearing as if minute areas of mucosa had been removed with a sharp curette. They are always small, varying in our cases from 1 by 2 mm. to 4 by 5 mm. Surrounding the larger ulcers is an area of intense congestion and œdema which the smaller ulcers often lack. As has been our experience in two cases, the ulcers may show active bleeding. Touching the ulcer with a catheter or probe at once produces bleeding, and the patient will complain of sharp pain. The bladder base, including the trigone and ureteral orifices, is always normal in appearance; not uncommonly, as the result of frequent urination, papillary hypertrophy of the internal sphincter is present.

Symptoms.—An analysis of the symptoms presented by our patients gives one common to all—bladder pain with intense urgency and frequency of urination. In the most severe cases the bladder must be emptied every few minutes, with pain during, but more especially after,

FIG. 1.—Cystoscopic picture showing diseased area above and normal mucosa with ureteral orifices below. Intense congestion about three small, superficial ulcers which are situated in lower portions of the œdematous zone. Section excised measured 7 x 7 x 4 cm. The disease was located in the vertex of the bladder, but is here shown near the base in order to demonstrate the essential features in one drawing.

urination. Often the dysuria is exaggerated at night, but the reverse may be true. There is an associated intense urgency, so that the patient finds it next to impossible to hold the urine. Not infrequently the pain is located in the lower abdomen, usually just above the symphysis on one or both sides of the median line. This is doubtless due to an extension of the inflammation to the peritoneum and the pain may closely simulate that of a chronic pelvic peritonitis or appendicitis. The pain may be localized to the bladder and lower abdomen or may be referred; in one of our cases intense rectal discomfort was complained of, in another a sensation of " spasm " in the perineal region, and Hunner calls attention to the frequency of referred pain in one or both hips, depending on the location of the ulcer. The severity of symptoms, of course, varies in different patients, and in several instances we have noted more or less of a periodicity of exacerbations and remissions, lasting several weeks and entirely independent of treatment. That this is not due to healing of the ulcers is evident from the fact that the remission occurs with no apparent change in the appearance of the bladder. As is so frequently the case in inflammation of the bladder, premenstrual congestion exaggerates the symptoms. The symptomatology is usually one of long standing; in our series the duration varied from six months to fourteen years, and the average is about four years.

As the result of years of bladder trouble, these patients have been under more or less constant medical attention and are consequently well versed in their urinary findings. As a rule, they report that the urine was found to be normal, but in two of our cases a history of hæmaturia was given. The bleeding is of short duration, lasting only a day or so, and then completely disappears, at least on gross examination.

Microscopic examination of the urine may be normal with the exception of a slight excess of leucocytes and a few red blood-corpuscles. In only two of our cases were many leucocytes reported. One case came to us with macroscopic hæmaturia which was found to originate in a small ulcer, two others showed a few red blood-cells in the centrifuged specimen, while the remainder showed none. A grossly normal appearing urine with the presence of a few leucocytes and red blood-cells may be said to be characteristic of the majority of these cases.

Etiology.—We are at a loss thus far to explain the cause of this condition, but believe with Hunner that it is due to an infection, probably hæmatogenous in origin. The tubercle bacillus is certainly not responsible. In no case has it been demonstrated microscopically nor by guinea-pig inoculation; nor is there anything in the cystoscopic picture or the sections of the bladder suggesting tuberculosis. Hunner seems inclined to ascribe the inflammation to an infection secondary to such a focus as tonsils, teeth, or sinuses; we have made it a special point to determine this possible etiology, but without success. In two of our cases the patients date the onset of symptoms from repeated catheterization, one

during an attack of typhoid fever, the other following an operation. The remainder can ascribe no probable cause.

In none of our cases has there been any evidence whatever of a gonococcal infection. The condition is not secondary to inflammatory disease of the pelvic organs, for no such condition has been demonstrated either by vaginal palpation or intra-abdominal examination. From the fact that the pathology is always limited to or is most extensive in the bladder vertex, one might consider the possibility of its being associated with disease of the urachus, but we have found no evidence of this.

Hunner reports a sterile urine in his cases; such has not invariably been our experience. In one there was a pure culture of colon bacilli, in another staphylococci and non-hæmolytic streptococci. In three the urine was sterile, while in the remaining cultures were not made.

An analysis of the clinical and pathological findings suggests the possibility that a paracystitis may be the primary lesion, and that the changes seen in the bladder itself are purely a secondary manifestation.

Treatment.—We have run through the gamut of local applications in our treatment of these cases and have come to the conclusion that Hunner is correct in his statement that "no form of treatment will suffice except complete excision of the inflammatory area." As previously stated, certain cases show periods of improvement lasting several weeks, which seem to be in no way dependent on treatment. Again, the symptoms may be somewhat relieved by applications of silver nitrate, silver iodide, carbolic acid, etc., but the relief is only temporary and nothing short of excision has in our hands given a permanent cure. We have not tried fulguration, but Hunner reports two cases in which this treatment produced such severe pain that the patients refused further applications; he has also used the actual cautery wire which seemed to lessen the symptoms somewhat, but did not cause healing of the ulcers.

Operative Treatment.—The operation consists in excision of the diseased area of bladder wall, and the limits of excision are determined not by the ulcerations, but by the distinctly outlined œdema. Anything short of this will result in failure.

Through a suprapubic incision, the bladder is exposed and opened, if possible, at a point previously determined by cystoscopic examination to be outside the area of œdema. The opening in the bladder is made sufficiently large to give a good exposure of its interior and the greatest care is exercised in handling the bladder to avoid an artificial œdema incident to trauma. By means of an illuminated vesical retractor, it is an easy matter to determine the limitations of the œdema, and these are marked by a series of linen traction sutures, passed deeply into the bladder wall to prevent their cutting out. Small ulcers which were plainly seen through the cystoscope in a well-distended bladder may at operation be difficult to locate at first glance. They appear as small, red spots which bleed easily on being touched with a cotton-covered probe.

Fig. 2.—Section of bladder wall, showing ulcer at A. Numerous areas of round-cell infiltration in submucosa. Œdema shown by looseness of muscularis. Only slight increase in connective tissue.

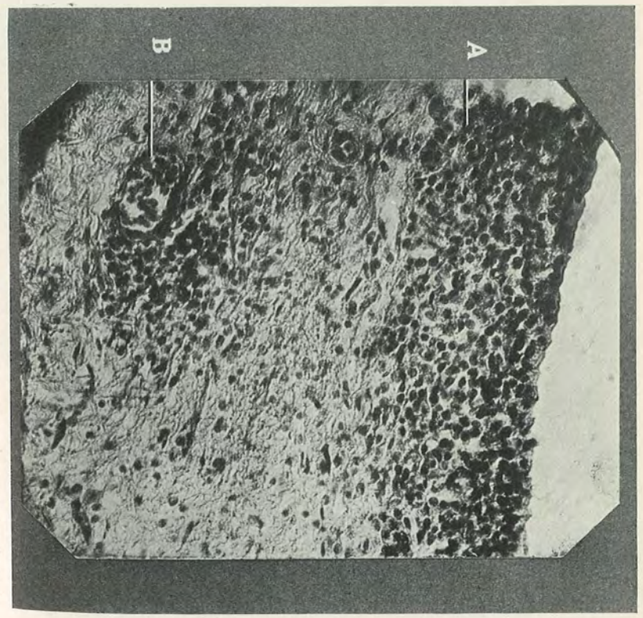

Fig. 3.—*A*, Mucosa in non-ulcerated area. Infiltration of round cells composed almost entirely of lymphocytes and plasma cells. *B*, Blood-vessels in submucosa filled with polymorphonuclear leucocytes, with perivascular infiltration.

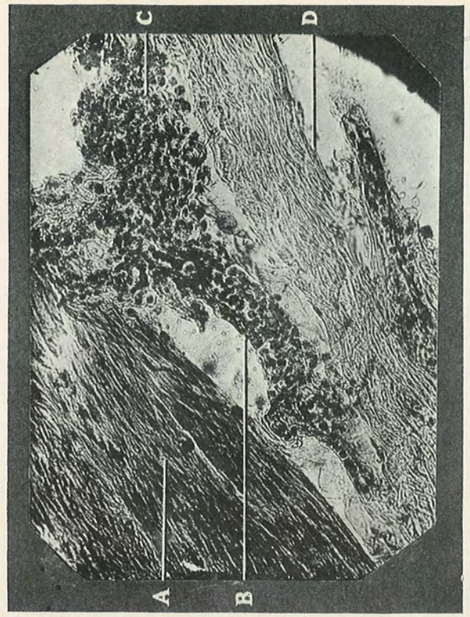

FIG. 5.—Taken from centre of muscular layer. *A*, Muscle. *B*, Large blood-vessels filled with polymorphonuclear leucocytes which can be seen invading vessel wall. *C*, Perivascular infiltration. *D*, Connective tissue.

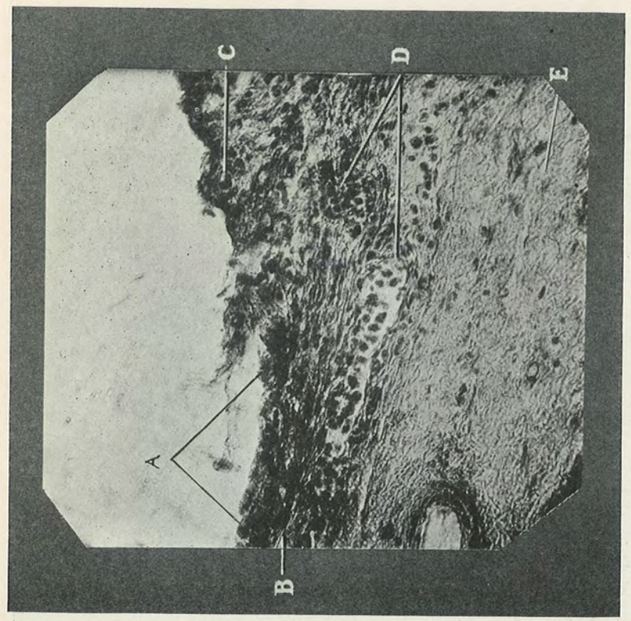

FIG. 4.—*A*, Base of ulcer showing absence of epithelium. *B*, Thickened basement membrane. *C*, Epithelium at edge of ulcer. *D*, Blood-vessels filled with leucocytes. *E*, Œdema of submucosa.

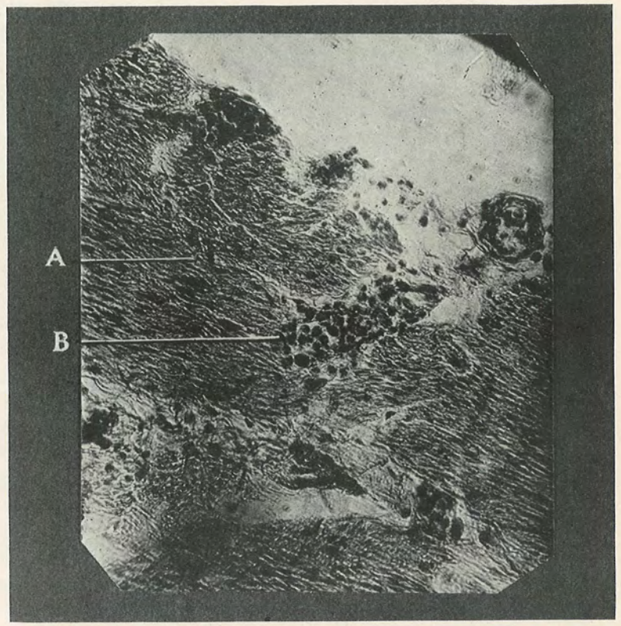

FIG. 6.—Taken from fibrous coat of bladder. *A*, Fibrous tissue. *B*, Blood-vessels filled with polymorphonuclear leucocytes which can be seen within the vessel wall. Also perivascular collection of leucocytes.

After placing the traction sutures, the bladder is freed as much as necessary and the area outlined by the sutures is excised. Ideally, the operation should be extraperitoneal, but occasionally, in spite of care, the peritoneum will be opened during separation of the bladder; we have seen no ill results follow. After complete hæmostasis has been obtained the bladder is closed with a two-layer suture of catgut, the first being submucous, the second intramuscular, and both of the Cushing type. A suprapubic drain is placed in the bladder through an angle of the incision, and a Mikulicz drain is placed in the prevesical space, well away from the suture line in the bladder wall.

Post-operative Treatment.—The Mikulicz drain is removed in forty-eight hours, the bladder drain at the end of ten days. The bladder is irrigated daily through the drain, with a catheter in the urethra to avoid the danger of over-distention. After removal of the tube we have found it advisable to continue the bladder irrigation, using a weak silver solution, until the healing is complete. The patient is instructed to retain the urine as long as possible in order to hasten the restoration of the bladder to its normal capacity, which requires, as a rule, about two months.

Results.—Eight of our cases have been operated upon, one by Doctor Hunner and seven by Doctor Clark. In all of these, various methods of treatment were tried and in none was more than a temporary lessening of symptoms obtained.

The first case, who had been under our care for some time, consulted Doctor Hunner, who operated upon her two years and a half ago; this patient is cured after many years of intense bladder symptoms. The time since operation in our cases is as follows: Case I, two and one-half years; Case II, two years; Case III, twenty-three months; Case IV, twenty-one months; Case V, sixteen months; Case VI, nine months; Case VII, three months; Case VIII, two months. We have followed the post-operative course of these patients very carefully and have a written or verbal report of all up to date. Seven have been cured, and in each the bladder capacity has been restored to normal. Case II had a urinary fistula at the site of the suprapubic drain for several months, but this has closed and the patient is now free from bladder symptoms. Case III was well for seven months when the symptoms returned during a severe attack of influenza. She has a recurrence of the œdema and ulceration on the left side of the bladder vertex and is returning to the hospital for a second operation.

In no series of cases that we have studied has greater appreciation of what an operation has done for them been shown than in the seven who have been cured. We have recently had the opportunity of making a cystoscopic examination of four of these patients, and the bladder in each presented a normal appearance with the exception of a thin scar line at the site of excision.

Non-operative Cases.—Case IX was examined two years ago on account of severe vesical symptoms. She had a myoma uteri the size of a two months' pregnancy and a typical lesion in the vertex of the bladder, with marked œdema and a single ulcer located in the median line, one inch posterior to the internal sphincter. She later consulted a surgeon in a neighboring city, who ignored the bladder findings and ascribed her symptoms to pressure of the tumor. A hysterectomy was performed, and at our last report there has been no relief of the urinary symptoms.

Case X has only recently been under observation. She was admitted to the hospital complaining of frequency and urgency of urination, with pain low down in the left side of the abdomen, referred to the left hip. On cystoscopic examination, œdema of the left bladder vertex was found, with an ulcer situated one inch to the left and one inch behind the left ureteral orifice, which is the first instance in our experience of ulceration near the base. Under confinement in bed and silver nitrate applications, the symptoms lessened, but the ulcer remained the same. Contrary to advice, she insisted on going home, and in a recent letter from her physician we learn that the symptoms have recurred with such severity that she desires to return for operation.

Summary.—1. Circumscribed pan-mural ulcerative cystitis is a distinct pathologic entity, characterized clinically by its chronicity, intense vesical symptoms, and a urine, usually sterile, containing a slight excess of leucocytes and a few red blood-cells; pathologically, by its location in the vertex of the bladder, presenting a sharply demarcated area of œdema with one or more small, superficial ulcers within this œdematous area. The inflammation affects the entire bladder wall and may involve the adjacent peritoneum.

2. The etiology is as yet undetermined, but it is probably due to infection of hæmatogenous origin.

3. Intravesical applications are of value only in giving partial and temporary relief. The best method of treatment consists in excision of the diseased bladder wall, the limits of which are determined by the extent of the œdema.

MALIGNANT DISEASE OF THE LUNGS, ITS EARLY RECOGNITION AND PROGRESSIVE DEVELOPMENT, AS STUDIED BY THE RÖNTGEN RAYS, WITH REMARKS ON TREATMENT*

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of Philadelphia, Pa.

Preceding the study of the chest by means of the röntgen rays, an antemortem diagnosis of malignant disease of the lungs, according to Warfield, was not made in a large percentage of cases because of the general good condition of the patients and the indefinite symptoms which this disease produces. Even with the study of the chest by means of the röntgen rays, I am sure that the disease is not generally recognized in its earliest stages. In its earliest stages I believe that it cannot be definitely diagnosed by any means. In its latest stages it should not be mistaken by any röntgenologist. By reviewing the röntgenograms of a large number of patients, some of which have been followed over a period of several years, during which we have studied the progressive changes in the lesions, and by reversing the study, we have been able to trace the gross lesions back to their very incipiency. As a result, I am hoping that we shall be able to recognize this disease much earlier than it has ever been recognized heretofore. There is, of course, a microscopical stage in its development at which time we can never hope to recognize the disease.

Its early recognition will serve as a guide in the treatment. In some instances it will prevent a mutilating operation, and I am hoping in the future that its early recognition may lead to the early institution of some form of constitutional treatment which is, as yet, undiscovered. I am sure that at present many patients are operated upon with the hope of complete recovery at a time when there is already distinct metastasis in the lungs and mediastinum. On this account I believe that we should urge a röntgen examination preceding all operations for carcinoma of the breast. When the lesions within the chest are doubtful, I believe that they should not stand in the way of an operation.

Malignant disease of the lungs may be divided into *primary* and *secondary* (or metastatic).

Primary malignant disease of the lung is rare. It is of two types: the nodular and the infiltrating. The nodular type consists of nodules developing near the roots of the lung, but also in the parenchyma, and consists of varying sized masses, rather sharply defined and irregularly outlined. The infiltrating type, which is the more common, begins at the root of the lung and gradually infiltrates the entire lung. This fills the entire chest, and may come on so gradually, and produce such indefinite

* Read before the Philadelphia Academy of Surgery, January 5, 1920.

symptoms, that the disease is not suspected until the entire lung has become filled, and until one side of the chest is entirely solid, associated with marked displacement of the heart and mediastinal tissues to the opposite side, and associated with the formation of pleural effusions early.

The symptoms associated with primary malignant disease of the lungs consist usually of dyspnœa, pain, with or without pleuritic friction, and dullness varying with the degree of the involvement of the lung. As a result of the extensive dullness, the first thought is a pleural effusion, but in aspirating the chest only a relatively small amount of fluid is obtained, and this is generally a bloody serum. When bloody serum is obtained in a relatively small amount, malignant disease should always be suspected, and a röntgen examination should be made if it has not been made previously. By means of the röntgen rays, one recognizes an opacity in the early stages consisting of a mass of infiltrating dense tissues about the root of the lung spreading towards the periphery. If the malignant disease is sarcoma, it is especially apt to extend outward along the septum between the upper and middle lobe, or between the upper and lower lobe on the left side, or about the middle lobe on the right side, and this may be a fairly early sign. If the primary malignant disease is carcinoma, it consists of an infiltrating mass about the root of the lung extending outward along the bronchial tree, I believe most frequently in an upward direction, which serves somewhat to distinguish it from the inflammatory infiltrations about the root of the lung which tend to spread downward. In the late stages the whole of one side of the chest is a uniform dense mass with displacement of the heart and mediastinal tissues to the opposite side, with generally clear lung on the opposite side. The lung area on the opposite side may be reduced to one-third or less. In less advanced stages the apex of the lung may remain clear and the lower portion of the base of the lung may remain clear, unless there is associated pleuritic effusion. Sometimes by varying the position of the patient this lower portion of the base of the lung can be demonstrated to be clear by displacement of the fluid upwards.

Secondary or metastatic malignant disease of the lung is very common, and I believe much more common than has been recognized up to the present time. In a quotation made by Warfield in the report of cases studied in Middlesex Hospital, he states that metastases were found in the lungs of 178 out of 516 autopsies performed on persons who had died from cancer of the breast, and he states that at least one-third of all patients dying from cancer of the breast have metastasis in the lungs. It would seem to me, from my studies, that the proportion would be even higher than this. Gross found in 432 autopsies, collected from various sources, metastases in the lungs in 49.9 per cent.

Metastatic sarcoma, in my experience, has mostly followed sarcoma (?) of the testicles, though it may, of course, be secondary to sarcoma anywhere in the body. The lesions are nodular and occupy more particularly

the parenchyma of the lungs. They are generally sharply defined and vary in size from a small pea to an English walnut, or rarely as large as an orange. They are probably carried to the lungs in the blood stream and are distributed as emboli in the terminal blood-vessels in the parenchyma. In none of these cases studied by me did the patients have any lung symptoms, and the disease in the lungs had not been suspected by the physicians who referred the patients—generally for treatment of some local recurrence or some other metastasis. This condition of metastatic sarcoma of the lungs occurs so frequently, in my experience, that I never start treatment of a sarcoma without examining the chest, and when metastatic sarcoma of this kind is found within the chest, the röntgen treatment has been of no avail.

Hypernephroma metastasizes early to the lungs, and I believe the chest should be examined in every case in which hypernephroma is suspected, or whenever hypernephroma has been diagnosed. In one case sent to me for post-operative treatment three weeks after the operation for hypernephroma, in which the patient's general condition was good and there was no thought on the part of others as to recurrence or metastasis, I made an examination of the chest and found undoubted evidence of infiltration of the lungs. This consisted, not of nodules, but of a general infiltration of small miliary bodies extending outwards from the roots of the lungs which somewhat resembled an infiltrating tuberculosis, but the lesions were more sharply defined and did not follow the usual distribution of tuberculosis. The appearances were sufficient to make a diagnosis when associated with the history, and the subsequent development of the case proved that my diagnosis was correct. I am not sure that this diagnosis could have been made from the plates without the previous history.

Metastatic carcinoma of the lungs, in my experience, has most frequently followed carcinoma of the breast. However, it must be admitted that I have had very much more opportunity of studying this group of cases than those belonging to malignant disease in any other part of the body. I have studied the chests in 225 cases of malignant disease of the breast. At present I make a chest examination of every patient referred to me for röntgentherapy for carcinoma of the breast, whether for the primary disease, ante-operative, or post-operative treatment. There have been long intervals in the past when I did not follow this procedure. My experience now convinces me that this should always be done. Metastatic carcinoma of the lung is of four types:

1. The *nodular type,* which we all have recognized for many years, and which is characteristic as early as the nodules can be demonstrated. These nodules are generally distributed in the parenchyma of the lungs, though they may be located about the roots as well as in the parenchyma. These nodular lesions vary in size from that of a pin-head to an English walnut. They are generally not very dense and are not sharply out-

lined, but present a fuzzy appearance suggesting cotton balls. They are very much less dense and less sharply defined than metastatic sarcoma, though their distribution is very similar. This is the type that has been particularly studied and described by Moore and Carman. Apparently no other type was recognized by them at the time of the complete and able presentation of this subject before the American Röntgen Ray Society in September, 1915. They describe the lesions as varying in density from a faint shading to a degree approximately that of the heart, depending on the stage of the disease. At the time of the presentation of this paper it was undoubtedly the most complete röntgenological study of this disease made up to that time, and in general represents our knowledge of the subject up to that date. They had made a study of 71 cases. The character of the distribution of these lesions would lead one to suspect, as Moore and Garman also suggest, that these metastases are embolic and travel through the blood rather than through the lymph streams.

2. The *infiltrating type, beginning at the hilus or mediastinum.* This, I believe, is the most common type and, as has been so well said by Holmes and Ruggles, is "unrecognizable in the early stages and unmistakable in the later ones." This begins as a general thickening or infiltration about the hilus which, in its earliest stages, resembles the inflammatory thickenings that we so commonly find in this region, but which I believe differs slightly in that it presents more localized density without outline at the very roots of the lungs. It then shades so gradually as it extends outwards that it is lost in outline. I think I notice, too, a greater tendency towards an extension upward about the upper bronchial tree and toward the upper lobe than is usually found in the inflammatory lesions, for, as we know, in the chronic inflammatory lesions giving rise to thickening about the hilus of the lungs, there is a tendency towards increased thickening about the lower bronchial trees as compared with the upper. This evidence, however, in this early stage is only suggestive, and is not characteristic. As the disease progresses this area of density increases, extending toward the periphery, but extending particularly toward the upper lobe. Associated with this there is a general increase in the width and density of the mediastinal tissues. In some cases this mediastinal thickening is greatest in the upper portion just below the inner extremities of the clavicles, and at times distinct masses can be recognized in this upper mediastinum. It would seem, from the location and general distribution and development of the disease in these cases, that it is a direct extension through the lymphatic system, just as it commonly extends through the palpable glandular system into the axilla, then into the supraclavicular region, and then into the mediastinum. Handley concludes that the vast majority of metastases are due to lymphatic permeation. It has seemed to me that, in some cases, I have been able to transform these lesions into dense fibrous tissue and, in a few cases, the patients are still living after several years. One patient is living nine

years after removal of both breasts for malignant disease, and eight years after definite mediastinal involvement. She has been treated by röntgentherapy and looks well.

3. The *miliary infiltration* (very similar to miliary tuberculosis), and consists of a fine mottling throughout the lung fields, but, as recognized also by Holmes and Ruggles, these small areas of increased density are a little larger, more dense, and more sharply outlined than those of tuberculosis. This type is more difficult to diagnose, I believe, than any of the others, and it is likely that the diagnosis could not be made excepting in association with the history and careful study of the clinical symptoms. The absence of fever and the absence of other symptoms of miliary tuberculosis will easily eliminate tuberculosis in the differential diagnosis. An infiltrating syphilitic lesion of the lungs may resemble it, but can be differentiated by means of a negative Wassermann test. Infiltration of the lungs associated with leucæmia also resembles this form of metastatic carcinoma, but a careful differential blood examination will eliminate the diagnosis of leucæmia.

4. This type consists in a *progressive thickening of the pleura* associated with pleural effusion. This type is probably a direct extension of the disease from the breast into the pleura. Deaver and McFarland say that in "advanced cases the intercostal muscles often become diseased, and in some instances the pleura is involved as a result of the extension of the cancer cells through one or other of the intercostal spaces." Handley found secondary nodules in the pleura in 38 per cent. of 422 cases.

It would seem, from the above types, that all the various theories as to the nature of the extension of metastatic carcinoma are clearly illustrated and that all the theories are correct in certain cases.

In a series of cases studied previous to July 1, 1919, consisting of 242 cases of carcinoma, we found positive evidence of pulmonary carcinoma in 216; negative, 29; doubtful, 7. This high percentage of positive findings is partially influenced by the fact that, in many instances, the examinations were made because disease was actually suspected in the chest, but it also indicates the advanced stages of the disease in which the majority of patients are referred for röntgentherapy.

Of the 216 cases of malignant disease of the lungs there were: Primary carcinoma, 2; metastatic carcinoma, 196; primary sarcoma, 7; metastatic sarcoma, 11.

Of the cases of metastatic carcinoma of the lungs the great majority were secondary to carcinoma of the breast. I am not specifying the number because it would give a wrong impression, since all patients suffering from carcinoma have not been examined. Of the cases of metastatic carcinoma of the lungs there were: Mediastinal and hilus involvement, 150; nodular, 34; miliary, 10; pleural, 12.

It is evident, therefore, that the mediastinal and hilus cases are almost five times as frequent as the nodular.

The statement has been made that fat patients are more liable to early and rapid metastasis than thin patients. I, therefore, studied the various groups as above arranged, with the idea of determining whether any of these groups were especially liable because of the amount of adipose tissue. Also to confirm or deny, if possible, the above statement as to the relation of fat and metastasis.

Of the mediastinal and hilus variety there were fat patients, 53; medium, 65; thin, 32. Nodular variety, fat, 5; medium, 17; thin, 12. Miliary, fat, 6; medium, 4; thin, none. Pleural, fat, 4; medium, 5; thin, 3.

It would seem, therefore, that the thin patients are slightly more liable to the nodular variety of metastatic carcinoma, and second that the fat and medium patients are very much more liable to metastasis than the thin.

In a series of 42 cases studied since July 1, 1919, in each series all patients who were sent for post-operative treatment following carcinoma of the breast were examined, and we found positive metastatic carcinoma, 17; doubtful carcinoma, 16; negative, 9.

It would seem, from these studies, that approximately 50 per cent. of the cases that come for post-operative treatment have metastatic carcinoma within the chest at that time. The effect of röntgentherapy on these pulmonary lesions is difficult to determine. One does not generally have the opportunity of studying these patients over a long period of time unless they are under some form of treatment. Therefore, we do not have the opportunity of comparing the progressive changes in a group of untreated cases with the changes that I can recognize in the patients which have been treated. In some of these patients treated some of the lesions seemed to have disappeared temporarily. In others, the lesions become more dense and more fibrous, resembling somewhat a fibroid phthisis. In a few instances the patients are still living several years after beginning treatment, and are apparently in good health. In most cases, however, while there is temporary improvement extending over a period of months or a year, the disease takes on a more rapid form of development with evidence of general carcinomatosis followed by death. The symptoms and röntgen findings which develop as a result of progression of the disease most frequently involve the spinal bones, but also frequently involve the upper extremities of the humeri and the upper extremities of the femurs. The liver, in the cases which I have had under treatment, has not become involved, as indicated by symptoms of enlargement, as frequently as one would suspect from the text-book statements.

Röntgentherapy in these cases does accomplish some good, and, in a number of cases, definite disappearance of lesions has been proven. One patient was referred to me by the late Dr. Wm. L. Rodman, who had one breast amputated and found to be sarcoma, and the other breast amputated a year later and found to be carcinoma, and then, within six months she was referred to me with a very definite mediastinal tumor, and this

was nine years ago. She is to-day in reasonably good health, is very stout, and X-ray examination shows partial calcification of this tumor. In some other patients I have found disappearance of the metastatic nodules in the lungs, and in others disappearance of the mediastinal involvement. In five patients I have been able to get a healing process in metastatic carcinoma of the spine. I have been able to get reformation of portions of ribs that had been destroyed by metastatic carcinoma, or at least in which the lime salts had all been removed, so that the outline of the rib could not be seen at the area of disease. These have reformed. Such results are only obtained occasionally, however. I believe that all cases can have their lives prolonged and perhaps made more comfortable.

In general, I believe that when the lungs are involved it must be looked upon as a part of a general carcinomatosis, and with few, if any, exceptions one cannot expect a complete and permanent recovery.

CONCLUSIONS

1. Primary malignant diseases of the lung is rare, but presents rather characteristic appearances röntgenographically.

2. Metastatic malignant disease of the lung is common, and should always be looked for in connection with advanced malignant disease.

3. A röntgen examination of the chest should be made in every case of carcinoma of the breast referred for operation or röntgentherapy.

4. Metastatic carcinoma of the lungs may be one of four types: Nodular, mediastinal with infiltration about the roots, general, miliary infiltration, or pleuritic.

5. Greater attention to details in these studies will lead to earlier recognition of the disease.

6. Röntgentherapy can be expected to prolong life and give some improvement in symptoms, and perhaps occasionally the life may be prolonged sufficiently to consider it a cure.

BIBLIOGRAPHY

Adler, Isaac: Primary Malignant Growths of the Lungs and Bronchi, Longmans, 1912.

Deaver and McFarland: The Breast, Its Anomalies, Its Diseases and Their Treatment. P. Blakiston's Son & Co., Philadelphia, 1917.

Handley: Cancer of the Breast and Its Operative Treatment. John Murray, London, 1906.

Holmes and Ruggles: Röntgen Interpretation. Lea & Febiger, Philadelphia and New York, 1919.

Holt, Oliver P.: Multiple Metastatic Sarcoma, with Report of a Case. Jour. Am. Med. Ass., 1916, lxvi, p. 171.

Jackson, H.: Multiple Metastatic Sarcoma of the Lungs. Jour. Am. Med. Ass., 1916, lxvi, p. 833.

Keilty, Robert A.: Primary Endothelioma of the Pleura. Am. Jour. Med. Sci., June, 1917, p. 180.

Moore and Carman: Radiographic Diagnosis of Metastatic Pulmonary Malignancy. The Am. Jour. Röntgenolog., vol. iii, 1916, p. 126.

Scott, E., and Forman, J.: Primary Carcinoma of the Lungs. New York Med. Rec., 1916, xc, p. 452.

STATED MEETING, HELD FEBRUARY 2, 1920

Dr. George G. Ross in the Chair

CASE OF JACKSONIAN EPILEPSY CAUSED BY BRAIN TUMOR. SUCCESSFUL REMOVAL OF THE TUMOR

Dr. A. P. C. Ashhurst reported the case of a patient, John T., thirty-one years of age, on whom he had recently operated at the Episcopal Hospital. The man was originally admitted to the hospital November 22, 1919, complaining of "headache and stomach trouble," and was sent to the Medical Ward, then in charge of Dr. M. H. Fussell; and was eventually transferred to the Surgical Service January 3, 1920, by Dr. John B. Carson, who had succeeded Doctor Fussell on duty in the medical service.

Doctor Ashhurst saw the patient first in consultation on January 2, 1920, and learned the essential facts of the history as follows: The patient's family history was negative. He was unmarried. He was born in Poland and came to the United States in 1912. He was a laborer, and his general health always had been good. He smoked and drank very little and had had no serious injuries and no operations. He denied venereal disease.

About a year ago the patient had his first convulsion, losing consciousness. Since then he had had eight other attacks of varying severity at intervals of weeks or months. Three weeks before admission (*i.e.*, about November 1, 1919) his family physician, Dr. Jacob B. Feldman, made a spinal puncture for a Wassermann test.[1] After this the patient developed headache and vomiting. In the three weeks elapsing between this visit to his physician and his admission to the hospital, he had five convulsions. If he tried to leave his bed he vomited. After his admission to the hospital, during the latter part of November and during December, he had five other convulsions, one of which at least was determined to be Jacksonian in type, beginning in the left hand.

The patient, while on the medical service, was seen with Doctor Carson by Dr. Charles W. Burr, Consulting Neurologist to the hospital, who was unable to make a diagnosis. It was learned after operation that

[1] This was reported negative, as was the blood Wassermann after his admission to the hospital.

the patient's physician, Doctor Feldman, had called Dr. Alfred Gordon in consultation, and that Doctor Gordon had suggested an operation on account of a bony lump in the skull in the right parietal region, and after seeing a skiagraph of the patient's head.

Examination (January 2, 1920) showed a young man with rather expressionless face, who felt fairly well when lying quiet in bed, except for a constant terribly severe headache, in the frontal region and on the top of the head. The right eye was kept closed or nearly so, but could be opened. The pupils were equal and reacted (rather sluggishly) to light and accommodation. An examination of the eye-grounds made by Dr. Harold G. Goldberg, Ophthalmologist to the hospital, on November 29, 1919, had shown that the right eye was negative, but that the left eye showed slight paleness of the nerve and disturbance of retinal pigment, and one minute hemorrhage of considerable duration down to the temporal side of the disk. Doctor Goldberg considered it a beginning of neuroretinitis. A subsequent examination by Doctor Goldberg, January 5, 1920, confirmed the above findings, but showed no changes since the previous examination.

There was no paralysis of any of the cranial nerves, and the chest, abdomen and genitalia were negative. The extremities also were negative except for slight accentuation of the knee-jerks. There was no Babinski, no ankle or patellar clonus, and no Kernig's sign.

In the right parietal region of the skull was a sessile exostosis, about 5 cm. in diameter and raised about 5 mm. above the surrounding surface. Pressure on this lump caused some pain. He said he noticed the lump first about five years previously, and that it had been very slowly growing larger. Questioned as to any injury to this region, he said that when he first came to this country (over seven years ago) he attended night school, and there were many fights among those standing in line waiting for admission, but he did not remember any specific injury to his head. Skiagraphs made by Dr. R. S. Bromer, Radiologist to the hospital, showed an area of rarefaction of the inner table of the skull corresponding to the site of the exostosis.

Here was a man, Doctor Ashhurst said, who besides having epilepsy, apparently Jacksonian in type, had intense and persistent headache, had unprovoked attacks of vomiting, had an abnormal bony lump over the right motor region, and who had changes in the left eye-ground suggestive of increased intracranial tension. He considered these facts sufficient to justify an exploratory operation. His opinion was that the exostosis itself might be sufficient explanation for the symptoms.

Operation (January 6, 1920).—Ether (intrapharyngeal). Operator, Doctor Ashhurst; assistants, Doctor Mendel and Doctor McGuire. A bone flap, three of whose sides measured about 8 cm. each, and whose base (in the temporal region) measured 3 cm., was turned down from the right motor region, the exostosis being about in the centre of the flap.

Bleeding from the scalp was controlled by Kocher hæmostats. The bone flap was cut by means of the Hudson trephine, Gigli saw, and De Vilbiss forceps. After raising the bone flap its under surface over the area corresponding to the exostosis was found eroded and hemorrhagic in appearance. The bone flap was therefore removed, together with a portion of the cranial aponeurosis which was adherent to the underlying exostosis (Fig. 1). (Time elapsed at this stage of the operation, fifty minutes.) The exposed dura was granular over an area corresponding to the exostosis, and it was determined to excise it. It felt a little less resistant than the surrounding exposed dura, but the entire surface exposed pulsated normally. After ligation of four or five meningeal vessels with fine silk on a curved needle, the dura was opened and a grooved director slipped inside, and a rectangular incision (5 by 5½ cm.) was made with scalpel upon the director, entirely surrounding the diseased dura. As an attempt was then made to raise the diseased dura by mouse-toothed dissecting forceps, it was found to be continuous with a tumor embedded in the brain. By careful preliminary double ligation (with fine silk on a curved needle) of all pial vessels entering the tumor, and dividing the vessels between the double ligatures, it was possible very slowly and cautiously to outline the tumor. By making gentle traction on the edges of the dura, and wiping away the convolutions of the brain with wisps of cotton (moistened in extremely hot salt solution) held in the fingers, the brain tissue very gradually was peeled off the tumor, millimetre by millimetre, the union between the two being like that of inflammatory lymph adherent to the intestines, and the friability of both brain and tumor being nearly as great as that of the flakes of inflammatory lymph. Only at one point was any apparent damage done to the brain, when the needle passed around one of the pial vessels pricked the cortex, which immediately became suffused with a pink color over an area about 1 cm. in diameter. After the region of pial circulation was passed, the remainder of the stage of enucleation of the tumor was almost bloodless, any very minute ooze being promptly controlled by application of wisps of cotton squeezed out of an almost boiling saline solution. The tumor measured 5.5 cm. by 5 cm. on its surface, and was 4 cm. deep (Fig. 2). The hollow left in the brain pulsated normally, but showed no immediate tendency to fill up (Fig. 3). (Time elapsed at this stage of the operation over two hours, about an hour being consumed in enucleating the tumor from the brain.)[2]

[2] The specimen was submitted to Dr. William G. Spiller, at the University of Pennsylvania, who reported, after examining it microscopically, that the tumor could be only one of two things—an endothelioma or a fibroma; and he was inclined to class it as the former. He was further of the opinion that such growths in the brain were frequently the result of irritation from a lesion of the skull, originally traumatic in origin. This had been Doctor Ashhurst's own belief at the time of the operation, and he was glad to have it confirmed by so able an authority as Professor Spiller. Krause [Surgery of the Brain and Spinal Cord; translated

FIG. 1.—J. T., aged thirty-one years. P. E. H. January 6, 1920. Bone flap removed from right parietal region, and containing an exostosis (hyperostosis). Above, the outer surface of the bone, with the portion of the cranial aponeurosis excised because adherent to the exostosis. Below, the inner surface of the bone, grooved by branches of the middle meningeal artery, and showing the rarefied area corresponding to the brain tumor. (Actual size.)

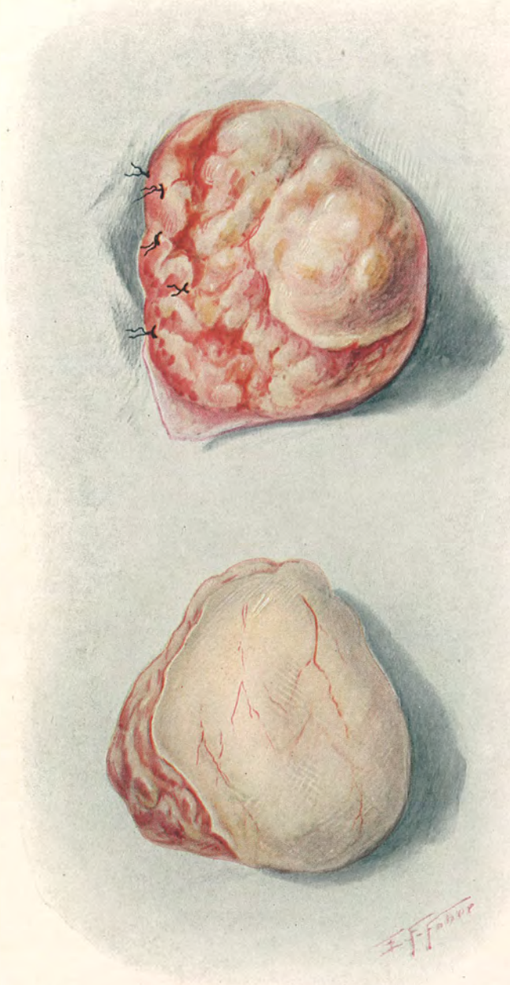


FIG. 2.—J. T., thirty-one years, P. E. H. January 6, 1920. Tumor growing from dura in right parietal region. Above, the cerebral surface of the growth, showing some of the ligatures in the region of greatest vascularity. Below, the cranial surface of the growth, showing the adherent dura excised with the tumor. (Actual size.)

During the removal of the tumor, Doctor McGuire cut a free transplant of fascia lata from the patient's right thigh, and this transplant (a rectangle 5 by 5.5 cm.) was sutured to the edges of the defect in the dura by interrupted silk sutures, and was gently pressed down into the hollow left in the brain. The flap of scalp was then replaced and accurately sutured (without drainage) by interrupted sutures of silkworm gut, the sutures being placed about 0.5 cm. apart, and thus effectually controlling all bleeding from the scalp.

The patient's condition was good throughout the operation, which was three hours in duration, and he left the table with a pulse of 128. At no time subsequently were there any unfavorable symptoms. For the first twenty-four hours after operation he said his left forearm and hand felt numb, but at the end of this time normal sensation returned to all but thumb and index finger. By January 18, 1920 (twelve days after operation), the index finger felt nearly normal, but the thumb still felt anæsthetic, though both index finger and thumb distinguished pin contact throughout. At this time the patient was fairly convalescent. He seemed much brighter than before operation, had no headache at all, but still felt giddy on sudden movements or on attempts to sit up in bed.

January 28th: Sitting up in chair.

Feburary 2d: Four weeks after operation. Walking about ward. Has had no convulsions since operation. If symptoms develop later from the skull defect caused by removal of the bone-flap, it is planned to do a second operation and fill the opening by a bone transplant from the outer surface of the neighboring skull.

June 7: Five months since operation. Has gained thirty pounds in weight. Has had no convulsions since the operation. His ears no longer buzz, but he has some consciousness of his brain in stooping (he has returned to his work as automobile mechanic) and in walking fast. On June 10th a bone transplant was cut from the left parietal region. consisting of the outer layer of the skull and overlying pericranium, and was inserted into the defect in the right parietal region which had been previously prepared for its reception. The patient, who was receiving ether by intrapharyngeal insufflation, was in good condition until the head was turned over to the left, for insertion of the transplant in the right. His condition at once became unsatisfactory, and in spite of stimulation he died, apparently of respiratory failure, as the scalp

by H. A. Haubold; New York, 1909, vol. i, p. 71], however, held the opposing view, that tumors of the dura were responsible for the growth of new bone in the skull. The latter view could justify one in replacing the bone flap after removal of the tumor; whereas, if the former is the correct theory, replacement of the same bone might in time cause another tumor to form. In 1899, Spiller reported a case similar to the one now recorded, and in 1907 reported a second case and reviewed the literature (J. A. M. A., 1907, ii, 2059). In advanced cases the thickening of the skull overlying the tumor becomes so widespread as to justify the name of *hæmicraniosis*, applied to it in 1903 by Brissaud and Lereboullet.

was being sutured. The duration of the operation was nearly two hours, but there was no evidence of shock: he ceased breathing some seconds before the heart beat stopped, and artificial respiration and cardiac massage (through the unopened chest and abdomen) were of no avail. No autopsy was permitted.

HÆMATOMYELIA, WITH CROSSED PARALYSIS
(Sensation on Left, Motion on Right)

Doctor Ashhurst also presented notes of the following case. He found the patient in the ward at the Episcopal Hospital when he took over Doctor Frazier's service from Doctor Mutschler, August 1, 1914. For the ward notes he was indebted to Drs. J. Walker Moore and J. P. Jones, the surgical internes.

The patient, a young man twenty-five years of age, was admitted July 23, 1914, and discharged October 29, 1914. On the day of admission at 7.30 A.M. he had been knocked backward from the deck of a ship to the deck beneath, landing on his forehead. He was not unconscious at all. He had no pain for the first five minutes, but then felt intense pain all over the body. After the fall he was unable to move a muscle of his body below the chin, but he could talk and move his eyes and eyelids normally.

On admission, at 2 P.M., the patient is paralyzed below the sixth cervical vertebra. He has great difficulty in breathing. He can talk, open his mouth, and protrude his tongue, but is unable to move his head or the rest of his body. There is no bleeding from the ears or nose.

He was placed on a water bed.

Physical Examination.—Fairly well nourished and developed young fellow. Temperature 102° to 101° F.

Head: Eyes react normally to light and accommodation; pupils are equal. Nose and ears are negative. Tongue is moist and clean, no paralysis. There is an abrasion and some slight swelling of the forehead. Complains of intense pain in the neck when the head is moved. There is no displacement of the spinous processes of the cervical vertebræ. He is unable to move his head at all.

Chest: The breathing is shallow and difficult. Lungs and heart are normal.

Abdomen: No respiratory movements of the abdominal muscles. There is a scar of a hernia operation in right inguinal region.

Extremities: All four extremities are paralyzed. The patellar and cremasteric reflexes are absent. The hamstrings and calf muscles contract when the overlying skin is pricked with a pin. The toes move when the sole of the foot is touched. There is loss of sense of pin prick on the entire left side up to the neck, but this sense is retained on the right side.

Six Hours Later.—Slight motion is perceptible in left arm and left leg; sensation remains about the same.

Ten Hours After Admission.—Is able to move the right arm also; can flex but not extend the elbow. Unable to move the right leg. Breathing is better. Pain is less. Knee-jerks still absent.

July 24th: Can move the right arm slightly. Has to be catheterized. No other changes. Temperature 101° to 100° F.

July 25th: Given a purge.

July 26th: Voided urine, and has control of his bowels. Slight increase in power of triceps in left arm. Fibrillary contraction of both lower extremities. Still unable to move right leg. Cannot move the muscles of shoulder girdle.

July 28th: Can move his shoulder muscles, no other change.

July 30th: Temperature has reached normal.

August 1st: Notes by Doctor Ashhurst:

Can rotate, flex and extend the head, but not strongly.

Right upper extremity: Can move the right shoulder. Trapezius, deltoid and axillary fold muscles all act slightly. Subscapularis, good. Biceps, good. Triceps, no power. No power in wrist or fingers.

Left upper extremity: Shoulder muscles are all good. Elbow good, but weak. Slight power in the extensors of the wrist and fingers.

Left lower extremity: Fair power throughout. Increased reflexes. Ankle clonus and Babinski present.

Right lower extremity: No power; spastic. Increased reflexes. Babinski present. Fibrillary contractures.

Sensation: Over the entire left side from the ninth intercostal space down, sharp and dull are called dull. The remainder of the body has normal perception of sharp and dull. Over the left lower extremity cannot distinguish hot from cold. Over the left abdomen and thorax both hot and cold are felt as hot. Elsewhere sensation of heat and cold are normal.

Neck: Third cervical spinous process appears to be more prominent than normally.

Diagnosis: Hemorrhage into substance of cervical cord; hæmatomyelia.

August 3d: Can flex right knee and hip with ease. No other changes.

August 4th: Skiagraphs negative for fracture of cervical spine.

August 13th: Can turn from side to side in bed, and raise entire body from bed. Sensation continues impaired on left side. Is moved from water bed to ordinary mattress.

August 15th: Good movements in arms and legs, but very little power in the hands.

August 18th: Can sit up in bed. Hands still very weak, but arms are becoming stronger. Perfect movement in lower extremities.

August 21st: Gradual improvement in all movements except the right hand.

August 29th: Can flex right index finger, but can move none of the other fingers or wrist on right. Can move all the right toes, but cannot

move the ankle-joint. The reflexes on right are greatly increased. The left extremities are normal.

September 2d: Able to move right thumb.

September 10th: Gradually getting more motion in fingers. Has now limited use of all fingers of right hand. Walks all over ward with spastic gait.

September 14th: Except for delayed sensation in left leg and foot, sensation is normal all over body.

September 20th: Goes up and down stairs, but with difficulty. Holds right hand flexed at wrist, and with metacarpo-phalangeal joints extended (Fig. 4).

October 20th: Very little spasticity in gait. Sensation now normal in left leg.

October 29th: Discharged and referred to Orthopædic Dispensary.

July 9, 1917: This date (three years after injury) he paid his first visit to the Orthopædic Dispensary of the Episcopal Hospital, when the following notes were made by Doctor Gill:

Has some atrophy of essential muscles of right hand with a tendency to contracture. Has weakness of triceps of right arm. Active abduction of right shoulder is slightly limited. Has loss of temperature sense on entire left side of body, except left hand and forearm. Has loss of tactile sensation on right side. He is unable to raise toes of right foot from floor. Works as toolmaker.

Proper treatment was advised, but the patient never returned, and cannot now be found; though it is known he was a visitor to a patient in the ward less than a year ago.

END RESULTS OF CERTAIN METHODS OF BRIDGING DEFECTS IN PERIPHERAL NERVES

Doctor Ashhurst presented two patients as clinical evidence of nerve regeneration after methods employed to bridge gaps in the peripheral nerves which are condemned by many neurologists and experimental physiologists. Both nerve stretching and nerve flaps are held to be not only useless, but positively harmful; but he believed these cases prove the contrary. No electrical reports of the muscles supplied by the damaged nerves are presented, because he had come to the conclusion after a not inconsiderable experience in such matters, extending over a period of seventeen years at the Orthopædic Hospital and Infirmary for Nervous Diseases, that where the voluntary contraction of a certain muscle is visible, such evidence is much more reliable than is that obtained by electrical reactions.

Nerve stretching to bridge gaps he had employed timidly and without much elongation of the nerves in his earlier cases; it was not until after repeated attempts at feeble stretching had showed no permanent damage was done to the nerve, that he had been emboldened to employ such forcible stretching as was adopted in Case III (William B.). And the result in this case is so satisfactory, and the method of operation by lateral anastomosis after stretching the ends until they overlap is so much easier than that by nerve-flaps or free transplants, that he should feel no hesitation in preferring it in future cases. It is no doubt probable that in this case the use of free transplants of fascia lata to surround the anastomosis promoted the return of function; but he believes the chief factor was apposition without tension, of broad areas of denuded nervous tissue. The idea of union by lateral anastomosis followed the recognition of the possibility and desirability of determining the extent of scar tissue in the nerve bulbs not by gradually advancing cross-sections as is usually done, but by a longitudinal splitting of the bulb. During suture the bulbs are still in place and by them the nerve may be easily controlled; and after suture he had not excised them, but merely left them as they were. Cases II and III were presented; Case I was absent.

Case I.—*Primary neuroplasty of the ulnar nerve.* Fred B., twenty-eight years of age, had his left forearm crushed between freight cars, early on the morning of December 12, 1909. He was brought to the Episcopal Hospital, in the service of Doctor Frazier, and was operated upon by Doctor Ashhurst about eight hours after injury. There was a compound comminuted fracture of the radius and ulna, with extensive laceration of the soft parts below the middle of the forearm. The bone ends protruded, and the laceration of the skin extended entirely around the forearm with the exception of about 3 cm. on the extensor surface.

Operation.—Ether. Esmarch band below shoulder. After débridement the ulnar artery was found crushed and its two ends widely separated; both were ligated. The ulnar nerve was crushed, nothing but a grease stained strand of sheath, 3.25 cm. long, joining its ends. After enlarging the incision to within 7.5 cm. of the internal condyle of the humerus and dissecting the ulnar nerve as high as this, as well as down to the wrist-joint, a gap of 1.25 cm. at least remained between its ends, even when put under considerable tension. After repair and fixation of the fractures, a flap 3 cm. long was turned down from the proximal end of the ulnar nerve and was sutured without tension to the distal end by one through-and-through mattress suture, and three sutures passing through the epineurium only. All these sutures were of fine silk. The severed muscles were repaired as well as possible, after swabbing the entire wound with very hot 5 per cent. solution of carbolic acid. The limb was dressed with alcohol-soaked gauze, was placed on splints, and was kept in vertical suspension for twenty-four hours.

The patient's temperature rose to 103° F. on the third day after operation, and there was some suppuration and a great deal of sloughing of skin and muscle; but the wounds were all healed by the end of February, 1910, about two and one-half months after the injury. Good union was

secured in the radius, but the ulna remained ununited. About a year after operation a sequestrum worked itself out from the radius.

The patient was last examined November 17, 1919, ten years after the operation. He continued his work on the railroad, and has no disability from his injured arm. His grip is strong, and he has normal power in forearm, elbow, and wrist. The ulna remains ununited. There is slightly diminished sensation in the ulnar distribution to the fourth and fifth fingers, but normal sensation in the ulnar distribution to the hand. All motions of the thumb and fingers can be performed—there is absolutely no paralysis of any of the thumb muscles, interossei or lumbricals. He cannot make a perfectly tight fist, but this is due to adhesions of the muscles in the forearm to the cicatrix in the skin. It is to be particularly noted that there is no deformity of the fourth and fifth fingers—there is full extension in the phalangeal joints and full flexion in the metacarpal joints, evidencing regeneration of the ulnar nerve.

CASE II.—*End result of primary neuroplasty of the median nerve.* James F., fifty-two years of age, caught his right forearm in a carding machine in the spinning mill where he worked and was at once brought to the Episcopal Hospital. On admission to the Receiving Ward, October 21, 1916, a large gaping wound on the flexor surface was found, and an Esmarch band was at once applied above the elbow to check the free bleeding. The wound was washed with carbolic acid solution (1:40), 1500 units of anti-tetanic serum were given, and he was sent to the operating room.

Operation was done by Doctor Ashhurst two or three hours after injury. There was a lacerated wound extending from the styloid process of the ulna to the internal condyle of the humerus, and on the flexor surface from the radial to the ulnar border, except for about 5 cm. at the upper end, where the wound tapered to a point at the internal condyle. In the lower part of the wound the radius was exposed, with some superficial destruction of the bone surface. The median nerve was exposed and torn, the radial artery severed, and the muscle bellies and tendons were exposed throughout, but were so lacerated that their identity could not be determined by inspection.

The wound was cleansed with turpentine, followed by soap and hot water, by alcohol, and finally bichloride of mercury solution. The proximal end of the radial artery was identified about 10 cm. below the bifurcation of the brachial and was ligated. The distal end was ligated at the wrist, the intervening portion having been carried away by the injury. The Esmarch band, applied in the Receiving Ward, was then immediately removed. An area of damaged skin, about 2.5 by 10 cm., was cut away. The ends of the median nerve were next identified, and a defect of 5 cm. discovered; even by gentle stretching both ends of the nerve and flexing the wrist it was impossible to make even the damaged ends meet, much less healthy nerve tissue. Therefore, a flap (about 3 cm. in length) was cut from each end of the nerve, the flaps were inverted, and sutured end

to end, without tension, by fine chromic catgut (Fig. 5). The damaged ends of the nerve were not excised, but two ligatures were tied around each to prevent the flaps from splitting all the way to the ends, as indicated in Fig. 5. The lacerated muscles and tendons were repaired as well as possible, and a few silkworm-gut sutures were applied across the wound from one skin edge to the other, but an area about 7.5 by 16 cm. had to be left uncovered. The hand and forearm were wrapped loosely in gauze soaked in alcohol, the limb was placed on a splint, and was suspended vertically for the first twenty-four to thirty-six hours; and for the first week the dressings were kept constantly moist by alcohol douches.

Ward Notes.—October 23, 1916: Patient claims he has perception of touch in hand and fingers, in area of median nerve distribution.

October 28, 1916: Belly of brachio-radialis is beginning to slough. Pain sensation in ulnar distribution. In middle, index and thumb only sensation of touch. Stitches beginning to cut and removed. Temperature 99° to 101°. Wound is 17.5 by 8.5 cm. Still alcohol douches.

October 29, 1916: Tendon of palmaris longus removed for sloughing.

FIG. 5.—Neuroplasty of median nerve, to span a gap of 5 cm. Ligatures applied to prevent nerve ends from splitting beyond the bases of reflected flaps. Case of J. F., 52 years, P. E. H., October 21, 1916.

October 31, 1916: Wound clean except over radial side, where is some exudate. Sensation in thumb, index and middle fingers.

November 1, 1916: Temperature normal and steady.

November 28, 1916: Sixty-two skin grafts applied by Dr. I. M. Boykin.

November 30, 1916: These all disarranged by patient moving, and to-day eighty-two others were applied by Doctor Boykin.

December 10, 1916: All grafts failed to take (infection).

January 6, 1917: Eighteen grafts by Doctor Boykin.

January 8, 1917: Grafts have taken; heliotherapy.

January 31, 1917: Discharged. Slight motion in fingers. Is able to flex and extend elbow somewhat. Wrist extends only to 150° or 160°.

February 5, 1917: Orthopædic Dispensary, Episcopal Hospital. Skin grafts have taken well, wound healed. Wrist flexed to 135°, cannot be extended. Fingers partly flexed. No active motion except slight flexion of fingers. Hand very stiff. To have massage.

May 21, 1917: There is an area of anæsthesia of the thumb, forefinger, and diminished sensation in radial side of middle finger. There is some rotation in the forearm.

October 15, 1917: Can almost touch palm with middle and ring fingers. Forefinger flexes to right angle. No motion in thumb. Sensation present except on inner side and dorsum of thumb.

October 7, 1918: No active motion in thumb except at metacarpal joint.

Can barely touch thumb to little finger; slight passive motion in metacarpo-phalangeal and inter-phalangeal joints. Unable to make a complete fist. Can barely touch the middle and ring fingers to thenar eminence. Little finger about ⅜ inch from palm, forefinger about one-half normal flexion. None of the fingers can be completely extended. At work since January, 1918, in spinning mill; not the same work as before injury, but almost same wages.

November 20, 1919: Examined by Doctor Ashhurst. He was out of work sixty-four weeks in all. He now makes higher wages than before injury, but in a less important position with the same firm. He uses both hands all day long, in hard manual labor, with grasping actions.

No anæsthesia. All the interossei act, all the lumbricals act. Adduction and abduction of thumb normal. Can appose thumb to index finger *strongly*. Can appose thumb to middle finger with fair power. Can appose thumb to ring finger, mere apposition. Can appose thumb to little finger with difficulty. All the voluntary thumb motion is at the carpo-metacarpal and metacarpo-phalangeal joints; but if the proximal phalanx is held by the examiner's fingers, slight active motion in the distal phalanx (flexor longus) becomes possible. Impairment of function of the flexor longus pollicis seems attributable to muscular rather than to nervous injury, as the lesion of the median nerve, and the site of its suture, was below the level at which its branch to the flexor longus pollicis is given off.

He can flex the index finger at the metacarpal joint to an angle of 120°, and at the proximal interphalangeal joint to 90°.

He can flex the third and fourth fingers until they touch the palm, and the fifth finger until it almost touches the palm.

There is slight atrophy on the radial surface of the thumb metacarpal, but no atrophy of the thenar eminence.

He can extend the wrist fully (no hyperextension) and can flex it to about 135°. Elbow motions are normal. Supination of the forearm is slightly limited.

The large scar on the forearm is supple and painless, the identity of many of the skin grafts being preserved; but the underlying muscles are slightly adherent to the skin in the middle third of the forearm, and these adhesions somewhat limit motions of the fingers.

CASE III.—*Successful end-result of secondary suture of median and ulnar nerves (lateral anastomosis) and many tendons in the forearm.*—Wm. B., eighteen years of age, on August 28, 1916, broke his fish aquarium, and the falling glass cut his left forearm on the flexor surface above the wrist. An immediate attempt at repair was made in the Receiving Ward of the Episcopal Hospital, by the interne then on duty; a number of severed tendons were sutured and the ulnar artery, completely divided, was ligated. The wound suppurated for several weeks, but healed about October 1st. In November, eleven weeks after the injury, the boy was

admitted to Doctor Ashhurst's service in the Episcopal Hospital with a useless hand. There was a cross-shaped scar on the flexor surface of the left wrist, extending to within 3 cm. of the crease of the wrist. The fingers were in full extension and could not be actively flexed, except for very slight power of flexion in the thumb. The fingers were all supple, and could be passively flexed. The wrist motions were normal actively and passively, and the extensor communis digitorum acted normally. There was no action of any of the interossei or lumbricales. There was anæsthesia in the median and ulnar distributions below the cicatrices. There was marked atrophy of the thenar eminence and more marked atrophy of the hypothenar. The thumb, as already mentioned, could be flexed very slightly, but could not be adducted, abducted, nor opposed. The skin above the wrist was adherent to a dense mass of scar tissue, in which all the flexor tendons were caught.

Evidently this was a case of complete block of the median and ulnar nerves, probably from complete division; also of loss of function of all the flexors of all the fingers and thumb, either from complete division or from inclusion in scar tissue.

Operation was undertaken November 15, 1916, nearly three months after the original injury. Under ether anæsthesia, and with Esmarch anæmia secured by applying the rubber band just below the shoulder, the longitudinal portion of the old scar was excised, and the skin on both sides was reflected. It was densely adherent to the tendinous cicatrix in the middle of the incision, but free proximally and distally.

A. By dissection the following structures were identified: (1) Palmaris longus, its proximal end being lost in the scar; no distal end was found. (2) Flexor carpi radialis; by extending the incision through the annular ligament, the flexor carpi radialis was traced and found to be carefully sutured to the distal end of the median nerve (bulbous). (3) Proximal end of median nerve, ending in the mass of scar tissue, with a bulbous extremity 1.25 cm. in length. (4) Ulnar vessels and nerve, both distal and proximal ends terminating in the mass of scar tissue, and their ends separated by 2 to 2.50 cm. The ulnar nerve evidently was completely divided by the injury and not sutured. (5) Cicatricial mass of superficial flexors, the distal ends of thumb, index and middle tendons not being united to the proximal ends. (6) Cicatricial mass of deep flexors, nowhere completely divided but adherent to the underlying bones and to the scar mass of the superficial tendons. All adhesions were dissected free.

B. The proximal end of the ulnar artery was newly ligated, as the dissection had opened its lumen. The following suturing was done: (1) The flexor carpi radialis was detached from its accurate end-to-end union with the median nerve, and was sutured to the flexor pollicis longus. (2) One of the unattached proximal ends of the superficial flexors was sutured to the flexor of the index finger. (3) The palmaris longus was sutured to the flexor of the middle finger. (4) The median nerve ends could not

be made to meet even after the dissection, and with the wrist flexed; therefore its proximal end was stretched for 5 cm. by pulling on the bulbous end with hæmostatic forceps. In this way the bulb was pulled down past the distal end. Both ends of the nerve were then denuded laterally on apposing surfaces and united by lateral anastomosis by means of three fine silk mattress sutures passing completely through the nerve (Fig. 1). (5) The ulnar nerve was treated similarly, after stretching its proximal end for about 4 cm. In this way broad surfaces of healthy nerve tissue were brought into apposition without tension. The Esmarch band, in place about one hour, was now removed. It was found no ligatures were required.

C. A portion of fascia lata, about 8 by 10 cm., was next excised from the region of the left great trochanter. This piece was cut in half (4 by 10 cm.), and one of these smaller pieces was again halved, giving two

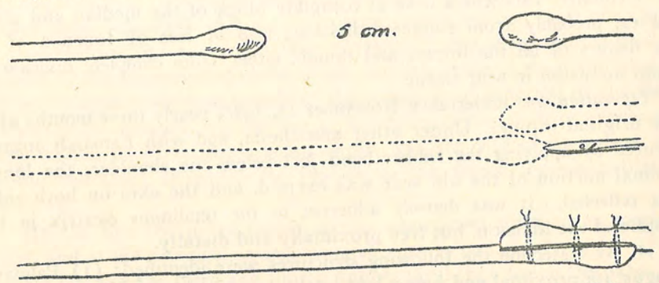


FIG. 6.—The bulbous end of nerve is caught in forceps and the nerve is stretched until the two ends overlap. They are then denuded on apposing surfaces, and united by lateral anastomosis. An actual gap of 5 cm. in the median and 3.25 cm. in the ulnar nerve was thus bridged. Case of W. B., aged eighteen years, P. E. H., November 15, 1916.

pieces about 2 by 10 cm. in dimensions. One of these small pieces of fascia lata was sutured around the median and the other around the ulnar nerve anastomosis, as tubes, being fixed proximally and distally to the nerve sheath by interrupted sutures; the suture for closing the tube in its long axis being continuous. The suture material was No. 000 chromicized catgut, threaded in a fine round needle. The remaining portion of fascia lata, 4 by 10 cm. in dimensions, was arranged so as to form one tube surrounding the bundle of the superficial flexor tendons, including those just sutured; this was to prevent adhesions between the superficial and deep flexors in the depth of the wound, and between the superficial flexors and the skin superficially. This portion of fascia lata was sutured around the tendons and fixed by sutures to the fascia surrounding the tendons as in the case of the nerves. The superficial fascia and the skin were finally closed in separate layers with many interrupted sutures of No. 0 chromic catgut, and the forearm was dressed on a splint.

The duration of the operation was two hours.

Healing occurred uneventfully. The splint was removed at the end

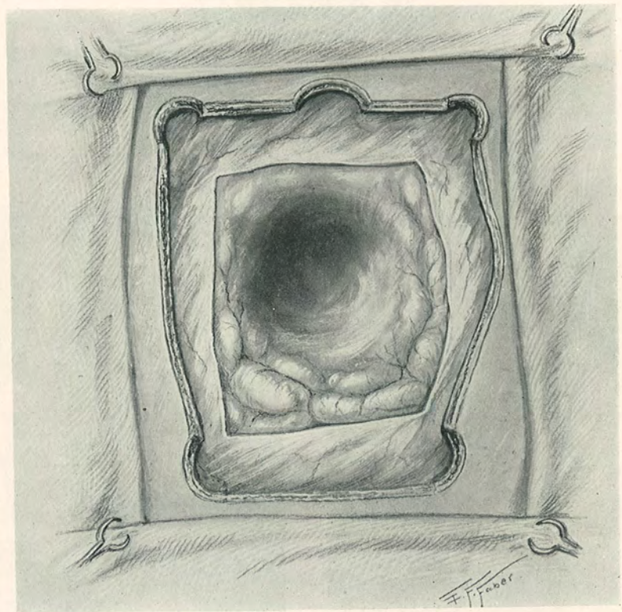


FIG. 3.—J. T., aged thirty-one years, P. E. H., January 6, 1920. Jacksonian epilepsy caused by brain tumor. Depression in brain from which tumor was removed, showing flattened convolutions. Re-drawn from a sketch made at the time by Dr. Mendel.

FIG. 4.—Case of hæmatomyelia three months after injury of cervical cord, showing residual paralysis. Episcopal Hospital.

FIGS. 7 AND .8—Three years after secondary suture of median and ulnar nerves, above wrist. Gap of 5 cm. in median and of 3.25 cm. in ulnar; spanned by forcible stretching of proximal ends of nerves, until bulbous ends overlapped. Lateral suture after denudation of opposing surfaces of nerves.

of the second week, and treatment by massage was instituted. This was continued for a year after operation, when approximately normal function had been regained. The patient was able to return to his work in a mill three weeks after the operation.

Examination in November, 1919, three years after operation, shows very little trace of the accident. There is slight fixation of the skin to the underlying tendons at one point. Full regeneration has occurred in both median and ulnar nerves, as evidenced by normal action of all the lumbrical muscles, of the abductor, adductor, short flexor and opponens muscles of the thumb, and by very nearly normal action of all the interossei; the only deficiency in the interossei is slight weakness in spreading the fingers apart (Fig. 7). Each finger can be moved separately in flexion and in full extension, though flexion is possible only until the finger tips touch the base of the palm; they cannot be flexed actively into actual contact with the middle of the palm, but there is normal power in the grip, and no disability in hard manual labor (Fig. 8). The thenar and hypothenar eminences are less well developed than in the normal hand; indeed, the entire left hand is somewhat smaller than the right. The deep and superficial flexors of all the fingers act separately, showing that they are no longer adherent to each other above the wrist. The thumb can be apposed to each finger, but not with much power to the fourth and fifth. There is, however, no power in the long flexor of the thumb, the distal phalanx remaining extended when the flexor brevis acts. As the distal end of this tendon was sutured to the proximal end of the flexor carpi radialis, the fact that it does not act cannot be attributed to failure of regeneration in the median nerve, the nerve lesion having been well below the level where its branches to the flexor longus pollicis and flexor carpi radialis are given off.

The movements of the wrist, active and passive, are normal. The lad works as an electrician, and is conscious of no disability in the use of his hand.

DR CHARLES A. ELSBERG, of New York, regarding the two cases (II and III) showing results of bridging defects in peripheral nerves, said that no matter how good the result one might get in rare instances, all evidence points to the fact that turning down a flap from a nerve from above or turning up a flap from below in order to bridge a defect is inadvisable. If regeneration occurs it has to take place in spite of the procedure and not as a result of it.

The literature of this subject was carefully gone over six months ago by Doctor Stookey, of New York, who published his conclusions in the *Archives of Neurology and Psychiatry* three or four months ago. He showed pretty conclusively that not a single instance, and certainly not in the original case of Letievant, could any regeneration be attributed to the procedure. Throughout the entire literature not a single permanent result was to be found. In one or two cases there was improvement, but

Stookey concluded that the improvement occurred in spite of the procedure and not as the result of it.

Regarding Doctor Ashhurst's third case, he could not agree with him that in sectioning the bulbous ends of divided nerves, it is difficult to determine when normal funiculi are reached. There is an essential difference between the central and peripheral end bulbs. In making successive cross-sections of the central end, one first sees one or two funiculi and the number gradually increases until the whole mass of normal funiculi is seen. In the peripheral end, however, one usually sees nothing but white scar tissue in each successive section until one section suddenly exposes a number of normal looking funiculi. In his experience, the question is largely one of understanding the funicular structure of the peripheral nerves and the appearance of normal funiculi.

The much spoken of case of MacKenzie did not prove anything. In his operation a large flap was turned up from the external popliteal and its branches in order to bridge a large defect of the sciatic. Careful study of MacKenzie's reports do not convince one that there was any real regeneration in his case.

SPECIMEN OF BRAIN TUMOR OF UNUSUAL DIMENSIONS REMOVED FROM A CHILD OF SIX YEARS

Dr. Charles H. Frazier presented a specimen to the Academy because of its unusual size, because of its peculiar surface markings, and because of the comparatively short duration of any symptomatic evidence of an intracranial growth. The patient, a child six years of age, was perfectly well until within five months of the operation. At that time the following symptoms were observed in the order mentioned: Vomiting, dulness, apathy, hemiplegia and imperfect vision. Upon examination the following clinical features were observed: (1) Head enlarged, suggesting hydrocephalus with distended superficial veins of scalp; (2) papillœdema of 4 D in each eye; (3) spastic hemiplegia, left; (4) convolutional markings of frontal bone.

Operative Record.—The operation was performed at three sittings. At the first the tumor was uncovered, but the enfeebled condition of the child did not seem to warrant further intervention at that time. One week later the flap was reflected and the tumor removed. It was easily differentiated from the surrounding brain tissue and seemed in size to occupy a space at least half as large as one hemisphere. The surface markings were not unlike that of the brain cortex, and those witnessing the operation thought a portion of the hemisphere was being removed. There was comparatively little bleeding until the tumor was finally separated from the falx. Hemorrhage was then profuse and could not be controlled except by pressure with a large cotton tampon. Any attempt to remove this tampon was always attended with recurrent bleeding.

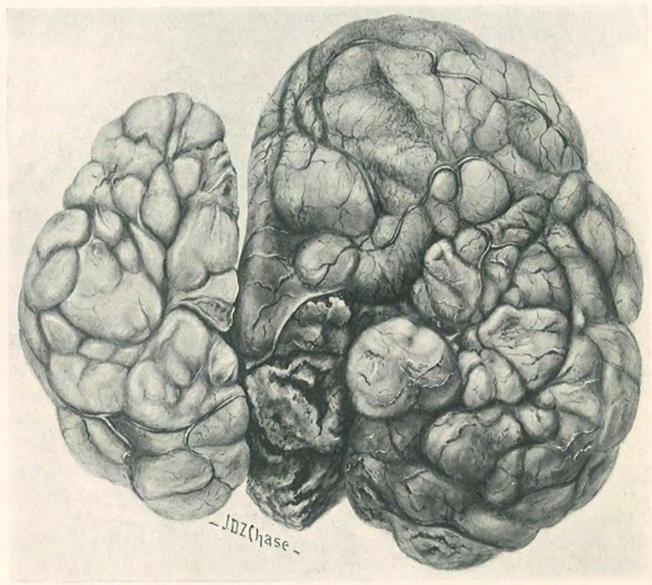


Fig. 1.—An endothelioma of the brain, composed of two sections apparently distinct, the one to the left measuring 7.5 x 4 x 3 cm. and that to the right 10 x 10.5 x 4.5 cm. The surface markings resembled somewhat the cortical convolutions and its capsule a pial membrane.

Accordingly the cotton tampon was allowed to remain *in situ* and the wound closed without drainage.

The presence of the large tampon gave rise to no disturbing symptoms until the fourth day, when there was a slight rise in temperature and a convulsive movement of the arm. The patient was taken to the operating room, where under very light ether anæsthesia the flap was again reflected, the dura opened, and the cotton tampon removed. Fortunately there was no recurrence of hemorrhage. The cavity was filled with salt solution and the wound closed for the third time.

Pathological Report.—Endothelioma. Specimen composed of two masses: (1) 10 by 10.5 by 4.5 cm.; (2) 7.5 by 4 by 3 cm. Irregular and nodular, covered with pial-like membrane. Surface convolutional. Interior composed of lobules yellowish gray in color (Fig. 1).

Summary.—Attention is called to the size of the growth; to the fact that despite its size the child was symptom-free until five months before its removal; to the peculiar convolutional markings; to the tolerance of the patient to the three operative sittings, and particularly to the tolerance of the patient to the large tampon of cotton, which replaced the tumor.

CANCER OF BOTH BREASTS

Dr. J. S. Rodman reported a case of sarcoma of the left breast and carcinoma of the right breast in same patient. Double amputation. Subsequent development of mediastinal metastasis. His reasons for reporting the case were: (*a*) Association of sarcoma and carcinoma in same patient. (*b*) Unusual length of life considering advanced state of disease. (*c*) Apparent arrest of mediastinal growth by X-ray.

The patient, a woman forty-six years of age, had known of tumor in left breast for two years. No pain, no trauma, no discharge from nipple, no abscess, but remembers that during first lactation left breast was "sore." Could not nurse second child because she did not have sufficient quantity of milk. Tumor remained about size of English walnut until six months prior to operation. Grew rapidly in this period, during which family physician was treating it with X-rays at first twice weekly and for the last five weeks daily. Was pronounced inoperable by another surgeon six months prior to operation.

Physical Examination.—Large solid tumor mass size of infant's head filling entire left breast. No retraction of nipple. No discharge from nipple. Not tender. Movable on chest wall. Axillary glands palpable.

Operation (October 28, 1910).—Dr. W. L. Rodman. Radical breast amputation, left breast, "Rodman" technic. There was a pathological controversy over the tumor. Two pathologists thought that it was not malignant, but fibro-cyst-adenoma, while the third thought it was unquestionably sarcoma.

In April, 1911, five months after amputation of left breast, she first noticed a small swelling about the size of an English walnut in the

lower inner quadrant of the right breast. There has been no increase in size of this tumor mass since first noticed. Breast is painful at times, especially at menses. As was the case with the left breast, there has been no history of trauma, no abscess, or discharge from the nipple. She has noticed a slight retraction of the nipple for the past three months.

Physical examination of right breast shows slight retraction of nipple. There are tender masses throughout the breast tissue, the largest of which is centrally located. Breast freely movable, no discharge from the nipple.

Operation (November 11, 1911).—Amputation of right breast, W. L. Rodman. "Rodman" technic.

Pathological Diagnosis.—Carcinoma of breast. Routine post-operative X-ray treatment following each breast amputation.

About eighteen months after amputation of the left breast and five months after right breast was removed, a bulging of the sternum was first noticed. X-ray showed this to be due to a mediastinal tumor for which she has been under X-ray treatment and observation since. Dr. S. E. Pfaller, who has given the X-ray treatments, states that the mediastinal growth is now calcified. She has gone for one year at a time without X-ray treatment, but is still considered as being under treatment.

Condition at present time, ten years after amputation of the left breast for sarcoma, nine years after amputation of the right breast for carcinoma, and eight and a half years after the mediastinal tumor was first noticed, is reasonably good. Her weight is about normal. The scars of operation show no sign of local recurrence. There is still marked bulging of the sternum, but probably no more marked than when first noticed. For the past six weeks she has had "choking spells" which come on suddenly during which she eructates quantities of gas and from which she gets almost immediate relief after sitting down. Her general physical examination reveals nothing to account for these seizures.

WELCH BACILLUS GANGRENE

Dr. DeForest Willard related a case seen by him in Hospital No. 1 in Paris in which the sera treatment was used in gas gangrene. It was that of a soldier with gunshot wound of the leg in which amputation had already been done in the middle third for gas gangrene. He came in in a distinctly shocked condition, with pulse very high and temperature moderately high. He was perfectly clear mentally. The thigh above the point of amputation was much swollen and very œdematous. The man was in extremis. Previously Professor Vincent, of the French army, whose polyvalent serum was being used exclusively, had given to the hospital staff a talk on his treatment. Professor Vincent was asked to come up and see this case. He gave the man, according to Doctor Willard's recollection, 60 c.c. intravenously. This was at four or five o'clock in the afternoon. The man was then thought to be in extremis. The next morning his pulse was good, below 100; temperature was down, swelling and œdema in his leg had decreased, and he from that time went on to recovery.

ABSCESS OF THE LUNG

Dr. John A. Hartwell read a paper with the above title, for which see page 51.

Doctor Müller said that he had often wondered why abscess has not been more frequently observed after lobar pneumonia. That it is common in cases of pneumonia coming to autopsy was well shown by Lord in 1915. He found abscesses in about one-fifth of the cases of bronchopneumonia and about one-fourth of the cases of lobar pneumonia. He suggests that the clinical infrequency of abscess in lobar pneumonia is more apparent than real and that certain cases of pneumonia are complicated by small losses of pulmonary substance which proceed to full recovery. Doctor Hartwell has shown us how this may occur and quite clearly the etiology of empyema from rupture of the peripheral abscess, a point recently manifested by Doctor Moschcowitz in his several papers. It is necessary to depend to some extent on classification in order to clearly determine in our minds the matter of treatment. Gangrene may be massive from obstruction of its blood supply or minute from the necrotizing action of an acute infection at the point of the abscess. Obstruction by foreign body may result in an abscess with bronchiectasis. Drainage, partial or complete resection, will depend upon the particular type which we encounter.

Dr. Howard Lilienthal said that Doctor Hartwell had shown a magnificent series of lung abscess operated upon by drainage with wonderful success. Other cases he has especially mentioned would probably not be cured by drainage, but only by radical procedures, such as lobectomy. It is my belief that all the abscesses which come from blocking of the bronchi and which are sponge-like are impossible to drain. No patient with a thoroughly established abscess of this kind, which has lasted for more than two months, will be cured by attempted drainage. That patient must be satisfied by such relief as may be afforded by washing out with a bronchoscope, but he has still a progressive disease. To be really cured he must submit to a resection of the lung, which is a dangerous operation. However, when that lung has been resected and the patient has recovered from the operation, he is well. The gangrenous abscesses, as Doctor Hartwell calls them, I have been afraid to operate upon by resection. I have treated them by incision and drainage, with varying results. The chance of curing a case of this kind by drainage is not bad if he withstands the immediate consequences of the operation, but the danger is very, very great in these acute gangrenous abscesses. It had been his custom to watch from day to day with a fluoroscope or

with X-ray pictures, and if he saw that they were increasing in size, the patient running septic temperature, he operated, but with a high mortality rate. He did not believe in the indiscriminate aspiration for the purpose of locating an abscess which one wants to operate upon. The X-ray and bronchoscope will locate the abscess without the danger of infecting the chest wall with anaërobes from aspiration puncture. I have recently seen two patients die without operation merely from chest-wall phlegmon following aspiration.

Doctor Hartwell seems to have had very wonderful success by the drainage of these abscesses. In the last six years the speaker had drained twenty-three of these abscesses and had saved 34 per cent. and a fraction. Another 34 per cent. have died and 30 per cent. are alive but not well, not speaking of the bronchiectatic abscesses. Of those he had had eighteen. He had refused none for operation. He had resected the lobe and lost 55 per cent.; the others are well—no cough, no signs of disease. From the therapeutic end of the subject it is important to remember that in the bronchiectatic abscess it is probably wiser even with the big risk to perform resection or removal of a lobe than merely to attempt to drain. I used to drain these cases and lost nearly every one from hemorrhage sooner or later after operation. If an abscess is a very large one and the danger of pneumectomy is too great, an operation has been attempted of ligating the pulmonary artery. There are other procedures which cannot be gone into now. The case which Doctor Hartwell showed in which the lung had apparently disappeared and in which there was a pneumothorax which was not perfectly aseptic but which really closed from the outside, was very illuminating. In a patient of that sort in which he had removed the two lower lobes and part of the upper lobe, and in which the rest of the upper lobe atrophied, the man was perfectly well, but twice has had a reopening with a little discharge from the chest. This closed and the man is now well and at work.

THE MANAGEMENT OF TOXIC GOITRE FROM THE SURGICAL POINT OF VIEW

Dr. Charles H. Frazier read a paper with the above title, for which see page 63.

Dr. Charles N. Dowd remarked that in hearing Doctor Frazier's paper one must be impressed with his method of estimating the patient's strength and then fitting the surgical procedure to it. This is the essence of goitre surgery. The individual surgeon must fit his procedure to the individual patient.

The estimation of the patient's strength depends on clinical observation rather than upon reading. When men write about the grades of toxicity we do not know that their standards are the same. One man's "moderate toxicity" may be another man's "severe toxicity."

Doctor Frazier, in an earlier paper, noted the sparsity of reports from the Atlantic seaboard as compared with the interior of the country. It is possible that different localities differ in type of goitre as well as in its general prevalence, and this difference must be interpreted in planning treatment for the individual patients.

Many observers have adopted a classification which corresponds fairly well with the three main groups of Plummer and Wilson: (1) Non-hyperplastic non-toxic. (2) Non-hyperplastic-toxic. (3) Hyperplastic-toxic.

The groupings on this basis as made by five observers are indicated in the following table:

	II	III
Frazier	35.7 per cent.	31.6 per cent.	32.6 per cent.
Wilson and Plummer	43 per cent.	14 per cent.	42 per cent.
Rogers			25 per cent.
The writer (137 hospital cases reported in 1915)	48.1 per cent.	27.5 per cent.	24.4 per cent.
The writer (61 later personal cases)	20 per cent.	55 per cent.	24 per cent.

We thus see that there is considerable variation either in the type of cases or in the interpretation of their toxicity.

Among his later cases the writer has seen many who are either entirely unsuitable for operation or only suitable. For example: (1) A man of forty who had recently come from Ohio with typical symptoms of acute hyperthyroidism, died at his home during the short period which was given to the making of the desirable laboratory tests. (2) A woman of sixty, who had suffered for many years and who had reached the terminal stage of degeneration of the internal organs, was almost moribund when seen and died a few hours later. (3) There were four cases who reacted fairly well to the preliminary ligation of the superior thyroid arteries but who refused, or procrastinated, the secondary operations when the suitable time had arrived, and thus became extremely toxic. (4) There were other cases in whom the diagnosis was not clear. It was doubtful whether the symptoms were really dependent upon the goitre.

It is manifest that the method of dealing with cases must be selected with care and that suitable recourse should be made to X-ray, boiling water injection, rest, medication, anoci procedure, or whatever seems indicated.

Most surgeons must learn some of this by experience. Personally, the writer had developed considerable confidence in the possibility of dealing successfully with the difficult cases by operation, but the procedure was interrupted by three fatalities within two years; one, an extreme case of hyperthyroidism who died under a preliminary ligation, and the other two moderately severe cases who died, one of œdema of the lungs and the other of pneumonia, each two days after operation. These fatalities naturally made a radical revision of standard of operation, and since then it has not been difficult to operate on a continuous series of

seventy-six cases without mortality; a series which is not larger when compared with the reports of several other surgeons and which without question embraces a lower average of severe toxicity than does the previous group.

Dr. John Rogers said that he agreed with Doctor Frazier concerning the value of the mechanical tests; that is, they are far from being definite and infallible and to be of any value must be compared with the clinical findings. The calorimeter test which shows the rate of metabolism is the most useful. I was somewhat disappointed in Doctor Frazier's indications for operation. For it is possible to divide these cases into more or less easily recognizable groups according to the extent and location of the diseased alveoli in the thyroid; and each of these groups can be best treated by its appropriate type of interference. It is now generally accepted that the symptoms of the so-called "toxic" goitres are produced by some abnormal secretion which emanates from certain hyperplastic alveoli. If the diseased tissue is removed the toxic symptoms disappear.

1. When these symptoms occur in the presence of a goitre which is symmetrically enlarged and of even consistency throughout it is presumable that all the hyperplastic tissue cannot be excised unless the entire gland is sacrificed. If one-half or two-thirds of the organ remain this small portion may contain enough hyperplasia to continue the disturbance. In these cases I advise the ligation in two stages of all four of the chief thyroid arteries. My results in several hundreds of such cases show ultimate cures by this operation in the neighborhood of 90 per cent.

2. When one lobe is much larger and denser than the other it is presumable that all or the greater part of the hyperplasia can be removed by excision of the most diseased lobe. In addition, and at the same time, when there is doubt about the remaining lobe, its superior thyroid vessels can be ligated. This limited use of hemithyroidectomy is most satisfactory when one becomes accustomed to examining the gland with a view to the histology of its contents.

3. When the toxic symptoms emanate from the interior or immediate circumference of a toxic adenoma or cystadenoma, the symptoms will disappear almost immediately after enucleation or excision of the adenoma. All the sound tissue possible should be preserved. It is generally immaterial whether at the same time both or one of the superior thyroid vessels are tied. I generally practice this procedure as a precaution against relapse. I wish to protest most emphatically against the present widely accepted advice, to excise in all so-called "toxic" goitres, four-fifths or five-sixths of the gland. In the first place, the symptoms of "toxicity" are by no means well defined nor clearly understood even by the most experienced. In the next, the thyroid gland is far from being a functionally useless or unimportant part of the organism, and experience has abundantly demonstrated that a "toxic" goitre may under indifferent or non-surgical treatment change into a simple or non-

toxic and otherwise symptomless goitre. That is, the hyperplastic alveoli may and can change into the normal type. It is generally understood that these cases will show hypothyroid symptoms at one period and at another, perhaps six months later, show distinct signs of hyperthyroidism. I have observed this so often and in such regular sequence that I have before this called attention to what seems to be the natural history of the disease. It apparently begins with the symptoms and history which are those of fatigue, and it can only be distinguished from simple fatigue by the presence of a perceptible thyroid enlargement. This initial stage may then pass into a true myxœdema or more or less gradually be followed by the signs of so-called hyperthyroidism, to which exophthalmos may or may not be added. If these observations are correct they mean that the patient with hyperthyroidism is suffering not necessarily from too much thyroid but from an abnormal functionation of the thyroid. Such an individual seems to be endowed with, or to have acquired, a thyroid which in attempting to perform its duties "gives out" or "runs amuck." The impulses which thus seem to drive the organ beyond its capacity must in part, at least, reach it through the circulation, and hence it is logical to cut off these impulses and to enforce "rest" upon the gland by ligating its chief afferent vessels. To ruthlessly sacrifice three-fourths or five-sixths of this gland, as is so frequently advised, especially in a patient who gives a history of a longer or shorter period of hypothyroidism preceding that of the hyper stage, is, I am convinced, to inflict in many instances an irreparable calamity. With the prevailing uncertainty in the interpretation of symptoms and the inexperience of the many operators who enter this field, it is far wiser to preach conservation rather than destruction of this important organ. Doctor Frazier failed to discuss, at least at any length, the clinical evidences of "toxicity." In my laboratory studies upon the effects in dogs of the injection of various thyroid extracts and derivatives, the reactions have almost from the outset been recognized as confined to stimulation of the functions believed to be performed by the terminals of the autonomic or vagus system of nerves. The terminals of the opposing or sympathetic system seem never to be affected.

The autonomic system seems to have the general effect, as determined by electrical and chemical experiments, of stimulating vascular and functional activity. The sympathetic terminals, on the other hand, apparently have the opposite effect, or that of inhibition of vascular and functional activity. Adrenalin and all derivatives of the adrenal gland which contain adrenalin are accepted as having a selective and stimulant affinity for this particular group. In general, therefore, the autonomic nerve terminals with their affinity for the thyroid product, may be said to "drive" the viscera, while the sympathetic adrenal combination shows an opposing or "check" influence. Hence, in the presence of an overacting thyroid gland there is evidence in the skin, circulation, and viscera of

too much "drive." If the thyroid is underactive there is an apparent insufficiency of "drive"—tachycardia is directly traceable to the influence, not of the vagus, but of the sympathetic nerve, and in my laboratory tests I have never found any normal or pathological thyroid derivatives which would, within the usual period of a few hours necessary for kymograph tracings, excite any appreciable degree of tachycardia. If, however, the thyroid feeding is continued for many days the result corresponds to the accepted dogma. Then there does follow tachycardia and increased metabolism. This does not prove that the thyroid activates the sympathetic. It seems more probable that the tachycardia is due to acceleration of the entire bodily chemistry, and perhaps directly to increased metabolism of the heart muscle itself. Hence, one should at least be cautious in believing that every case of tachycardia with a "goitre" requires the destruction of the greater part of the supposedly offending thyroid gland.

ABSCESS OF THE LUNG

By John A. Hartwell, M.D.
of New York, N. Y.

There exists in the literature some confusion as to the lesions included under the term abscess of the lung. In this communication a definition is employed which it is believed accurately describes the lesion, and at the same time is comprehensive enough to include the associated necrosis which so often is a part of the lesion.

Abscess of the lung means a collection of pus within the destroyed lung parenchyma; that is, it must be outside the lumen of the respiratory tree. Dilatation of the bronchi with a purulent inflammation of the mucosa and an excessive expectoration of foul sputum is not to be confused with abscess. This lesion—bronchiectasis—may coincidently be present, but is not necessarily so. Surrounding the abscess—really a portion of its wall—there often exists a destruction of lung tissue which may be somewhat massive and approach gangrene. One must, to a certain extent, be empiric in delimiting this lesion from a true gangrene. When the condition has resulted from bacterial invasion, *via* the respiratory tract, and is early manifest by the suppurative process, the term gangrenous abscess is accurately descriptive. Gangrene should be reserved for a massive destruction of lung tissue, either from true circulatory disturbance, or from such an overwhelmingly virulent infection that the lung tissue is killed in mass by toxins or vascular plugging before there can be a sufficient reaction to generate pus. If this division be followed, the number of cases of lung gangrene reported will be materially lessened, and a better understanding of the pathological processes be possible.

A case of true gangrene—the only one coming to my personal attention—has recently been reported to me through the courtesy of Dr. Lincoln Davis, of the Massachusetts General Hospital. A child received a penetrating wound with a crochet needle into the upper right lobe of the lung. Two days later she began to suffer pain and marked swelling around the site of puncture which rapidly increased up to the time of her admission to the hospital, one week after the injury. She was then very sick, the manifest signs being an emphysematous cellulitis in the neck and upper chest, with evidence of a hæmo-pyo-pneumothorax. Thoracotomy was performed. Death occurred the following day. Autopsy showed the entire upper lobe of the lung converted into a necrotic sac

* Read at a joint meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 2, 1920.

containing brownish opaque fluid. There was neither the surrounding inflammatory zone nor the pus content of an abscess formation.

Dr. Albert Frost, of the Interne Staff, has made the following summary of autopsy findings from the protocols of six thousand autopsies at Bellevue Hospital for the purpose of studying the relations in this type of lesion. There have been 148 cases with the anatomical diagnosis of lung abscess and gangrene of the lung. Abscess and gangrene are included in this summary under one head, because of the fact that so many of the cases of so-called gangrene of the lung cannot be differentiated from abscess.

Of the 23 cases with an anatomical diagnosis of gangrene, only 7 could be definitely spoken of as a true gangrene from the descriptions.

Of these 148 cases there were 50 which should be regarded as clinical abscesses, in that the abscess was of such size that it could have been detected before death, either by physical examination or by X-ray. Of these clinical abscesses there were 25 situated in the upper lobes, 22 in the lower lobes, and 3 in the middle lobe.

Other interesting data are briefly summarized in the following table:

Subpleural abscesses associated with empyema	34 cases
Abscesses mentioned as having ruptured into the pleura in which there was an accompanying empyema	12 cases
Empyemas mentioned as draining through the trachea	2 cases
Abscesses mentioned as rupturing into bronchi	15 cases
Pus from abscess mentioned as having foul odor	47 cases
Abscess result of necrosis of infarcted area	17 cases

The etiological factor in the production of these abscesses, including both the clinical and pathological lesions, was, so far as possible, determined from the associated autopsy findings. Only those cases in which the cause was evident are included in the following:

Bronchopneumonia	29	Septic endometritis	7
Lobar pneumonia	18	Infective endocarditis	6
Pyæmia	15	Acute suppurative otitis media	5
Septicæmia	11	Thrombosis pulmonary artery	4
Thrombosis in peripheral venous channels (sinus, jugular and inferior vena cava)	8	Purulent bronchitis (cause or effect)	3
		Tracheotomy	2

In the literature the differentiation between abscess and gangrene is often made from the odor of the sputum and the pus. Exceedingly foul pus is made to connote a gangrene without regard to the pathology. This, obviously, is incorrect, as is proved by the clinical and pathological cases described. In several of these the pus was stinking, and yet the evidence is conclusive that no true gangrene was present.

While abscess of the lung may result from other sources, the great majority have as a direct antecedent some type of respiratory infection, if, in such infection, the aspiration inflammations be included. In the literature the statement is found that among these the true pneumococcus lobar pneumonia is the most common antecedent. We have not found

this to be the case, either actually or relatively. Of 13 cases, associated with a pulmonary infection, observed clinically, 10 of which will be analyzed in detail, only 3 followed this type of infection. What is still more significant, in each of these three, secondary invaders were found in the abscess content, and the pneumococcus apparently had no part in abscess formation.

MacCallum, in a personal communication, says, "I am skeptical about those abscesses said to occur in the course of a pneumococcus lobar pneumonia. At least, they never look like abscesses, but like areas of more advanced destruction with no special limitation." He expresses the belief that even these are due to secondary invaders; an opinion amply sustained by our study.

In 770 consecutive cases of pneumococcus lobar pneumonia admitted to the Rockefeller Hospital, only 2 developed lung abscess, and each of these showed other infecting organisms. One of them completely recovered from the lesion in the lobe first involved, and later the abscess containing no pneumococci, formed in the other lung, in a part where the evidence of lobar pneumonia was very recent and scant. In this series there were two others showing a pneumococcus infection, but the diagnosis of a lobar pneumonia could not be substantiated by the physical signs or the radiograph. During the same period there were 140 cases of bronchopneumonia admitted, one of whom developed a lung abscess.

The entire number of abscesses observed in this hospital has been 9, the remaining 6 being divided as follows: 2 followed previous tonsillectomies with mixed infections; 1 occurred primarily with a staphylococcus aureus infection; 2 occurred primarily with a very mixed bacterial infection, and 1 resulted as a late manifestation of a staphylococcus aureus pneumonia. Our studies lead to the conclusion that the staphylococcus aureus is an important agent in abscess formation.

Great interest attaches to the subject of the pathogenesis of the abscess. In this connection the recent studies of Cecil and Blake are important. These authors found in their studies of the pathogenesis of pneumonia and other pulmonary infections that the inflammation in the lung parenchyma, following injections of virulent cultures into the trachea of monkeys, preceded by some hours the exudation in the air vesicles.

Inasmuch as the infecting organisms must sooner or later invade and break down this interstitial tissue, if an abscess is to result, this very early invasion throws light on the occurrence of a primary abscess, that is, pus formation before there is any pneumonic consolidation. In fact, in some cases, such consolidation may never appear. More often, however, the presence of a true consolidation may be demonstrated. The changes from this condition with the vesicular exudate and the interstitial inflammation to abscess formation are to some extent elucidated by the study of the pneumonic lung, particularly when there exists a mixed bacterial flora.

Many cases of pneumonia coming to autopsy exhibit areas in which the interstitial spaces are packed with the products of the pneumonic inflammation, the vesicle walls are more or less destroyed, and the lung substance is converted into an acutely inflamed zone showing foci of necrosis. In many instances these foci have progressed to a farther stage and liquefaction is present, *i.e.*, a beginning abscess (Figs. 1 and 2). The majority of such foci are very small, and while pathologically they are abscesses, this could not have been determined clinically. It is to be assumed that, had such cases survived, there would have occurred, in some, at least, a farther development, and clinical evidence would have been present. Chickering and Park found in the lungs of patients dying from staphylococcus aureus pneumonia, multiple abscesses varying in size from a millimetre to a centimetre. The content varied from a necrotic mass to a thick, greenish, yellow pus. In no instance was the abscess large enough to have given clinical signs.

All these studies emphasize the belief that lung abscess is a very important possibility much more often than is realized. We have no knowledge of how frequently these small focal abscesses form and undergo resolution and drainage, but this evidence is in favor of its frequent occurrence. We are not informed as to the causes which bring about their continued growth into large abscesses. One is compelled to fall back upon the unknown factor of resistance and virulence, with, in addition, the factor of a better or poorer drainage *via* the bronchioles. Study of the bacteriology yields the information already mentioned. Abscesses are encountered clinically, following all types of pneumonia, but the rule is to find a secondary invader, such as staphylococcus or streptococcus, occurring alone or in conjunction with the influenza bacillus. All these organisms have been found in the sputum of patients suffering from lung abscess. On the other hand, all types of lung infections regularly occur without the development of lung abscess. The clinical facts on which to base a belief that the ordinary pyogenic bacteria, particularly the staphylococcus aureus, are more prone than other organisms to produce a lung abscess are given above. It is to be emphasized that a staphylococcus aureus infection may produce an abscess without a true pneumonia. A well-marked abscess may occur almost with the inception of this infection, and be fully developed within a few days of the onset of the illness. Such a lesion is the primary lung abscess already mentioned.

There is, in every case of abscess, an exit for the fluid pus *via* the vesicles and small bronchioles. This drainage, however, is often inadequate, and following the law of all suppuration, the process extends along lines of least resistance. Abscess cavities, from five to ten centimetres in diameter, up to an entire lobe, may thus be formed. A fluid content of several hundred cubic centimetres is not uncommon. Ultimately, a larger bronchus is opened to it, drainage is free, and the complete pathological picture of the abscess is present. Often several large bronchial openings into the abscess are present.

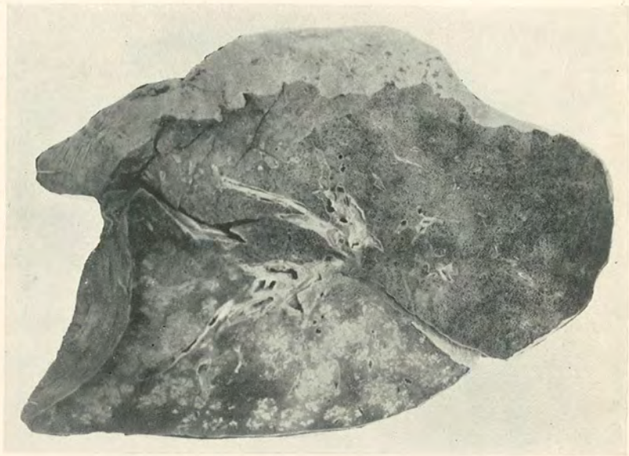


FIG. 1.—Lobar pneumonia showing the areas of necrosis, which are the starting points of abscess.

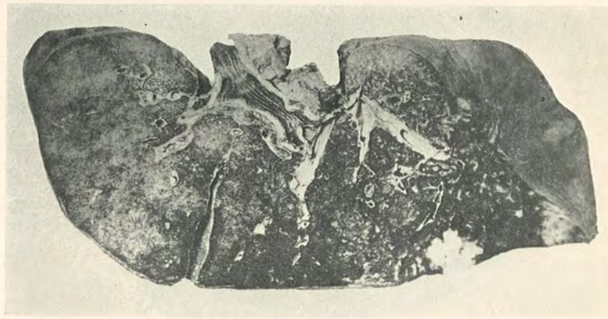


FIG. 2.—Influenza pneumonia, showing a necrosis beneath the pleura with a nearby large bronchus. This type of pneumonia with necrosis and abscess may also produce an empyema which will drain through the abscess cavity and the bronchus.

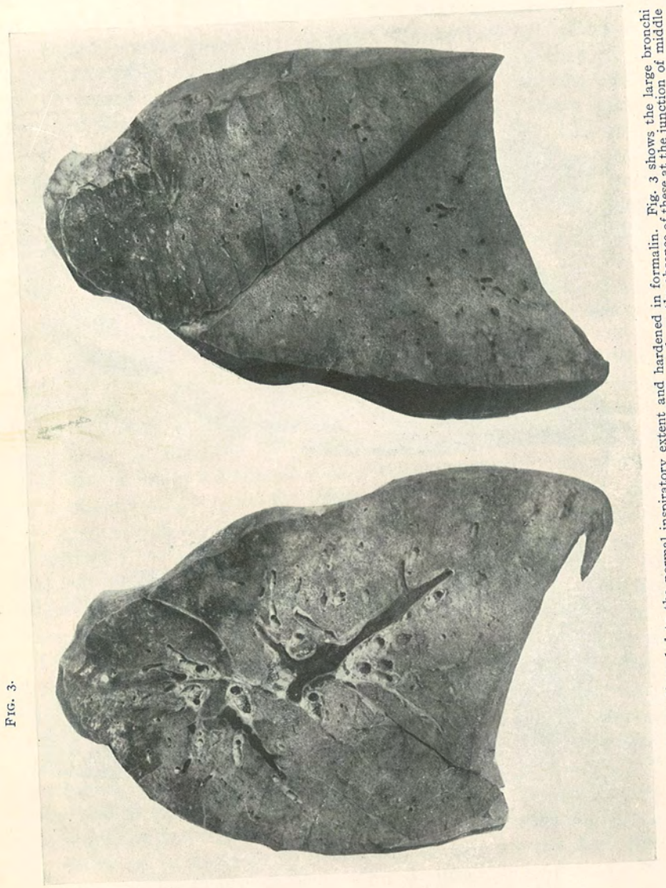


FIG 4

FIG. 3.

FIGS. 3 and 4.—A lung distended to the normal inspiratory extent and hardened in formalin. Fig. 3 shows the large bronchi ("drainage tubes") at the junction of the middle and deep thirds, while Fig. 4 shows the absence of these at the junction of middle and superficial thirds.

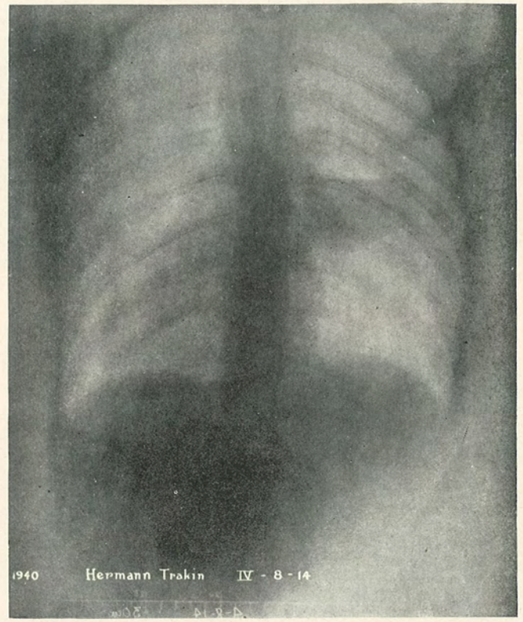
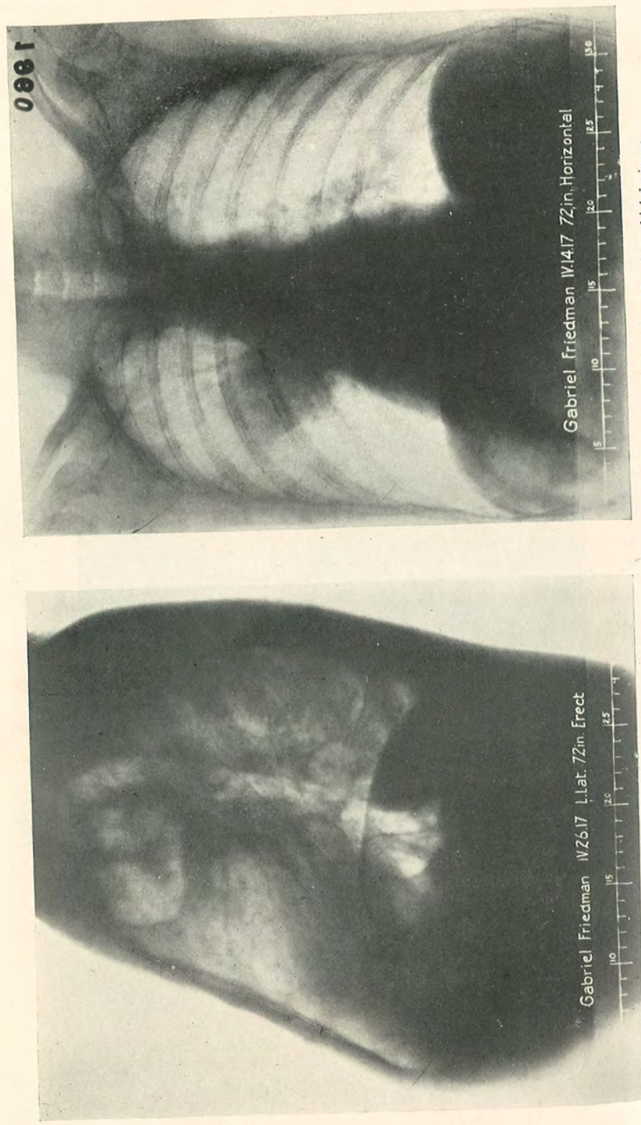


FIG. 5.—A typical shadow of an abscess cavity containing pus below and air above.



FIGS. 6 and 7.—A deep-seated staphylococcus abscess slowly working toward the anterior wall in spite of free bronchial drainage.

An abscess in the more superficial parts of the lung tends to reach a considerable size before it lies in relation to a bronchus of sufficient lumen to afford an avenue of adequate drainage. In the deeper parts, on the other hand, such bronchi are more numerous, and it is possible for drainage to be more complete (Figs. 3 and 4). This is an important fact from a therapeutic standpoint. It also has a most important bearing, as we believe, upon the occurrence of empyema and its occasional drainage through the lung and trachea.

When the abscess is fully established, as seen, for instance, at operation, its wall is a ragged surface of necrosing lung tissue around which, microscopically, are found œdema, leucocytes, dilated and thrombosed blood-vessels and bacteria, all of which pack the air vesicles as well as the interstitial space. Its outline is often irregular, giving the impression that several foci of suppuration have coalesced into one abscess. Between these diverticula the lung substance may be dead in considerable areas. When the infecting organisms are unusually virulent a surrounding gangrenous condition may supervene. Putrefactive organisms gaining entrance from the mouth to such areas produce a putrid mass. Such lesions are not uncommon, and should be designated as already discussed, as gangrenous abscess rather than lung gangrene.

Since, whatever the cause of the abscess, there exists an antecedent inflammation, the surrounding zone is always well marked. It is emphasized in abscesses secondary to the pneumonic infections, because such abscesses occur in portions where resolution has been incomplete and the interstitial inflammation is marked. In studying the physical signs of abscess formation and in reading radiographs, this zone must be given due consideration. It often acts as a very troublesome mask to a proper diagnosis.

The following case[1] illustrates the pathological and clinical development of an abscess as the sequela of a true lobar pneumonia, where the pus formation was due to a mixed infection.

> On February 6, 1914, the patient, a male, aged forty-two years, developed a left upper lobar pneumonia with typical signs and X-ray findings. The sputum was rusty from the onset. On admission two days later there was isolated from the sputum a Gram-positive diplococcus, a Gram-negative capsulated bacillus, the Friedlander and the influenza bacillus. On the fourth day of the disease there was elicited a flat note over the centre of the consolidation. Resolution and deffervescence failed, and on February 21st there were made out the signs of cavity formation, but the X-ray failed to demonstrate any change in the shadow.

[1] All the clinical cases herein reported, with the exception of the last one, were observed and treated at the Rockefeller Institute Hospital. I desire to express my thanks to Dr. Rufus Cole for the privilege of having treated them and including them in the report.

On February 27th there appeared the first expectoration of pus, 250 c.c., from which the same organisms as found in the early sputum were isolated. The physical signs and the X-ray now fully demonstrated the presence of a cavity in the centre of the upper left lobe. His general condition remained excellent and operation was delayed until March 7th with the hope that sufficient drainage, *via* the trachea, might result in a cure. This failing, the surgical procedure followed in all the cases was undertaken. The exact position of the cavity was determined with the exploring needle, and under novocaine anæsthesia a portion of the underlying rib—in this case the fourth to the left of the sternum—was resected. The two pleural surfaces being found adherent, they were incised, and by blunt dissection the abscess cavity was opened. It was about 10 cm. in diameter and pathologically showed the typical lesion described above. The pus contained the organisms above named, with the exception of the pneumococcus. Tube, and later vaselined gauze, drainage was established, and healing was complete on May 8th.

The course of the abscess development is in this case sufficiently clear by reference to what has already been said. The severity of the interstitial infection produced a local inflammation which failed of resorption (Figs. 1 and 2), and in the course of two weeks pus formation was present, and a week later a bronchus of sufficient size for internal drainage was opened into.

This case contrasts quite sharply with the following, who developed a well-marked left lower lobar pneumonia on April 20, 1914. On admission three days later the sputum showed a pneumococcus and a Gram-negative bacillus. The process in this lobe went on to a normal resolution on the seventh day, with a normal temperature. On April 25th, however, pain and friction râles developed over the right upper lobe. On May 5th the temperature rose to 103.4°, and signs of consolidation developed in the right lung anteriorly. An exploratory needle puncture in the third space, 5 cm. from the right edge of the sternum, entered a pus and air cavity. Cultures from the pus gave a pure growth of hæmolytic staphylococcus aureus. Operation showed an abscess which was multilocular, each focus containing only a few c.c. of pus with an extensive surrounding zone of necrotic lung. A cure resulted in about two months.

This case illustrates the rôle of the staphylococcus aureus in abscess production. The lobe first attacked followed the normal course of a pneumococcus lobar pneumonia, but another lobe attacked by the staphylococcus promptly passed into the suppurative condition and developed an abscess.

A third case presents still another phase of the subject.

The patient, a male aged twenty years, was admitted to the hospital on April 11, 1914, with the history of having had a cold for

two days and a chill and sudden pain in the right chest two days before admission. He suffered from a dry cough with occasionally the expectoration of a little mucopurulent sputum, which contained a non-hæmolytic streptococcus, a pneumococcus, and a Gram-negative bacillus, the latter predominating. There were no evident signs of consolidation made out at any time during the nine days he remained in the hospital. The temperature ranged from 100° to 102.8°, pulse about 80, and respirations 30. The X-ray on the third day following the chill showed a denser shadow corresponding to and extending immediately around the right hilus.

On the ninth day of the disease there occurred free expectoration of 100 c.c. of brownish-gray pus which contained characteristic elastic fibres arranged partly in alveolar form. These were recovered from a mouse inoculated with this pus: (1) Pneumococcus mucosa, bile soluble. (2) Pneumococcus IV. (3) Streptococcus hæmolyticus. (4) B. Influenza.

The X-ray (Fig. 5) now shows a distinct abscess cavity with a very limited surrounding zone of consolidation containing free fluid and air. This cavity was not determined by the physical signs.

An exploration needle introduced deeply into the substance of the lung through the sixth space, near the angle of the right scapula, withdrew pus of the same character and containing the same organisms. The patient declined operation and made a complete recovery.

This condition in which the abscess is an early manifestation of a deep-seated lung infection is contrasted with the more superficial abscesses. In the former the drainage may prove adequate because of the immediate vicinity of the large bronchi which act as efficient drainage tubes. In the latter extensive destruction of lung tissue must take place before such tubes are reached, and hence spontaneous recovery is less possible (Figs. 3 and 4). Not all deep-seated cases escape without operation, however, as is shown by the following:

A man, aged thirty-six years, was admitted to the hospital April 13, 1917. Two weeks prior to admission be caught cold and had a sticking pain in the *right* chest. He states there was cough and bloody sputum, but no fever. He was only absent from work for three days. A few days later there was a recurrence of illness with severe coughing, blood-tinged sputum, and sticking pain in the *left* chest. There was no chill and he states no fever until four days prior to admission. No history of having inhaled any irritating gas or foreign body could be obtained.

The physical examination revealed a soft friction rub in the left axilla, and below the angle of the scapula posteriorly there was a slight exaggeration in whisper. Elsewhere the lungs showed no abnormal signs. The remainder of the physical examination was negative. No portal of entry for infection could be found. Blood culture was sterile with 10 c.c. in 150 c.c. broth and 2 c.c. on 10 c.c. agar plate.

The patient appeared acutely but not seriously ill. Temperature, 102.8°; pulse, 95; respiration, 28; white blood-cells, 40,000. The only change in the general condition or physical signs, until the seventh day of illness, was the development of slight dullness over the left mid chest posteriorly. On that day there was severe coughing and suddenly purulent sputum was expectorated in very large amounts. It was greenish brown in color. Smears showed many varieties of bacteria. Injected into a mouse it yielded staphylococcus aureus in the heart's blood. Dulness with sonorous and sibilant râles were present over the left mid chest anteriorly.

Diagnosis of lung abscess with free bronchial drainage was made. It probably was of staphylococcus origin and lay deep within the middle portion of the left lung. The patient was kept under observation for ten days, because his general condition remained satisfactory, the abscess was draining freely and a serious question was present as to whether the better operative approach was from before or behind.

During this period the temperature ranged from 100° to 102.5°. Pulse 80 to 100. Respiration 22 to 32, and the blood count 40,000 to 50,000 with about 88 per cent. polymorphonuclears. The physical signs changed only in that dulness developed anteriorly over the left mid chest and percussion here elicited tenderness. The sputum was abundant, 190 c.c. on one occasion. It was almost pure pus, greenish in color, with tinge of blood, and of very foul odor. Staphylococcus aureus was recovered from the heart's blood of the mouse on several occasions following injections of purulent sputum. No source of a staphylococcus aureus could be found anywhere in the body. No tubercle bacilli were found.

The X-ray plates showed the development of the abscess and its approach to the anterior chest wall. They gave no evidence of a pneumonia or a tuberculosis (Figs. 6 and 7). The exploring needle inserted about the eighteenth day of the disease in the third intercostal space, at the outer border of the left pectoral muscle, entered the cavity and withdrew very foul, thick, brownish pus.

Under local anæsthesia 6 cm. of the third rib at this point was resected and immediately beneath the two layers of the densely adherent pleura and a thin shell of remaining lung tissue was found an abscess cavity 15 cm. in diameter contatining about 250 c.c. of the same foul pus. Internally, the cavity seemed to be bounded by the pericardium, but on all other surfaces there was comparatively healthy lung tissue. The pleural cavity was not infected. The abscess was in the inferior portion of the upper lobe. So far as could be ascertained the post-operative behavior of the lung condition was satisfactory. Drainage continued free and there was no other evident involvement of lung tissue. The patient, however, lost weight and strength, refused to eat, and died without evidence of sepsis three weeks following operation. No autopsy was granted and the immediate cause of death was not determined.

This case is of the type of primary abscess with the staphylococcus aureus as the exciting organism. The X-ray (Fig. 6) failed to show the usual shadow of a pneumonic consolidation. The abscess ruptured into a large bronchus with a resultant expectoration of a large amount of foul pus on the seventh day of his illness which is too early for the development of the abscess through a preceding stage of consolidation. Notwithstanding the deep-seated position of the lesion, and its early drainage by the tracheal route, it continued to extend toward the pleural surface, and obviously was not destined to recover without external drainage.

From the early sticking pain in the left chest and the friction rub heard in this axilla, it is evident that the original infection involved superficial as well as deep portions of the lung, but with not sufficient lesion to cast a shadow with the X-ray.

Suppuration occurred first in the more seriously damaged central portion and later extended into the superficial part where drainage was less complete. This was proved by the fact that at operation the two pleuræ were adherent and thickened, although the abscess itself was still situated some distance below the surface.

Other organisms than the staphylococcus aureus are capable of producing a pathological condition with similar clinical manifestations to those just mentioned, as is shown in the case of a man aged twenty-eight years who was admitted to the hospital on April 6, 1914. His illness began on April 2d with a chill and pain in the right chest behind. He immediately (?) began to expectorate large amounts of foul pus.

The physical signs were not marked, though some dulness existed with diminished fremitus and breath sounds over the lower right chest behind.

Two days after admission—the sixth day of his illness—an exploratory puncture deep into the right lung yielded very foul pus. Operation revealed a markedly inflamed lung with many small abscess cavities underlying the adherent and thickened pleuræ. The whole area of disease was evidently undergoing a breaking down suppurative process. The responsible organisms in this case, as determined both from the sputum and the pus, were Gram-positive cocci, Gram-negative fusiform bacilli, Gram-positive diplococci, and a short-chained coccus. The Gram-negative organisms were obtained only under anaërobic conditions. Healing was delayed until the twelfth week, owing to the presence of an open bronchial fistula, which only closed after nine weeks.

A case of true staphylococcus aureus pneumonia, with resultant multiple abscess formation—the type described by Chickering and Park—going on to recovery without operation, is illustrated by the following. A man, aged twenty-four years, was admitted to the hospital with this history. His illness began with an ordinary cold, after three days of which the patient had a chill and severe pain in the right side of the chest. He was admitted to the hospital

fifteen hours later. At this time he appeared very sick. Temperature, 105°; pulse, 124; respiration, 34; lips cyanotic. Examination showed evidence of a beginning consolidation in the right axilla. Sputum on culture yielded a pure growth of hæmolytic staphylococcus aureus. Blood cultures were negative.

On the fourth day of his disease, which followed the course of a severe pneumonia, the patient coughed up a mass of homogeneous, hemorrhagic sputum, swarming with staphylococci. The condition continued unchanged up to the eighth day. Exploratory puncture then yielded 10 c.c. of thick, grumous, chocolate-colored pus, smears of which showed only staphylococci.

On the thirteenth day the patient first began to expectorate freely pure pus, but in small quantity, after which there was a suggestion of amphoric breathing and loud râles in the posterior part of the right axilla. He remained acutely sick during this period, and developed foci of suppuration in two of his fingers and also in the chest around the site of the needle puncture. Other punctures into the lung were done on the twenty-first and twenty-seventh days, but in each instance the needle, as at the first puncture, passed into very solid lung tissue and only withdrew a few drops of pus, and in one instance entered a foul-smelling air cavity. During this period the amount of foul, purulent sputum gradually increased, but was not excessive until the thirty-fifth day, when, after coughing, there was a sudden gush of very foul-smelling pus which was projected outward like vomitus. From this time forward the progress was satisfactorily toward complete recovery, there being a gradual healing of the lung process. Complete recovery was established on the ninety-second day of his disease. Operation was deemed unwise in this case, because the process was an unresolved staphylococcus pneumonia with many small necrotic foci with which surgery would have found great difficulty in dealing. When the large abscess finally developed it promptly reached a large bronchus and a change toward recovery was immediately instituted.

Mention has been made of the relation of empyema secondary to abscess formation, and subsequent drainage of both the abscess and the pleural suppuration through the tracheal tree. I incline to the belief that this is the usual sequence of events when an empyema drains in this way. An abscess of considerable size develops in the superficial part of the lung, and failing to reach any bronchus of size, there is no expectoration of pus. Such a lesion gives no physical signs to differentiate it from the surrounding consolidation, and so is not diagnosed. In its extension it finally reaches the pleural surface, ruptures through, and produces a secondary empyema. The physical signs of the latter completely mask the abscess, and the case appears as an empyema only. The extension of the abscess, however, is also toward the deeper portion of the lung, and in this direction a large bronchus is ultimately reached, and there results a free expectoration of pus. This is interpreted as the "rupture

of an empyema" into the lung which is obviously an incorrect deduction. The actual lesion is a lung abscess reaching an outlet in two directions—first, into the pleura, and second, into the bronchus. Often expectoration of pus is not a marked feature, and operation on the empyema is undertaken prior to this secondary exit. The communication into a bronchus, however, exists, and following operation, one essential for the cure of the empyema is lacking, namely, the coincident expansion of the lung as the suppuration in the pleura is overcome. The open bronchus produces a continued internal pneumothorax, the lung fails to expand, and cure of the empyema is delayed long after the proper interval. This is often one of the underlying causes of persistent sinus following an operation for what was believed to be a simple empyema.

The employment of Dakin's solution for cleansing the pleural cavity after rib resection has demonstrated the presence of these coexisting lesions not infrequently. When present, the patient promptly smells and tastes the chlorine, and in many cases violent pulmonary irritation is set up with uncontrollable coughing. This never results when this solution is used in a simple uncomplicated empyema. Its appearance is proof that one is dealing with the condition under discussion, and in my belief, the use of Dakin's solution must never be continued, no matter how efficient one may have found it in the uncomplicated cases.

This occurrence of an empyema masking completely the presence of a large abscess of the lung was illustrated by two cases in this series.

In the first the illness began with pain in the right chest and the expectoration of foul pus. He was admitted to the hospital two weeks later, during which time the later symptoms had continued.

Examination by exploratory puncture showed that the right chest contained thick, yellowish-green, foul pus, similar in appearance to the sputum. Both contained Gram-positive and Gram-negative cocci and Gram-negative bacilli. Injected into a mouse there were isolated Gram-positive diplococci with large capsule (pneumococcus mucus). The exudate agglutinated with antipneumococcus serum III. The X-ray showed the shadow of a pleural effusion. Operation revealed a large abscess containing very foul pus in the middle of the right lower lobe. There was also a very thick fibrous purulent exudate in the pleura overlying this. The patient recovered, but still had a small clean bronchial fistula when last reported.

The second case is of unusual interest. The patient, an officer, aged twenty-three years, with the A. E. F., developed an arthritis in August, 1918, while on duty in the advanced zone. At about the same time he was slightly gassed with chlorine. He was sent to a rear hospital where, on September 15th, under local anæsthesia, a tonsillectomy was done. A month later he suffered from an attack of influenza and pneumonia. There is some evidence that prior to this he was ill with a pulmonary infection and at times expectorated pus, sometimes a "half cupful in a day." He remained ill through

the winter and was finally operated upon in March, 1919, for empyema. He was told that two quarts of pus were evacuated. Dakin solution was instilled into the pleural cavity on one occasion and he continued to "taste it for a week," so that it was not employed a second time. In the course of ten weeks the operative wound closed. On June 30, 1919, the X-ray and the physical signs showed that he had a complete pneumothorax, the lung having contracted to a small mass near the root and along the left border of the pericardium. The operative wound was still closed and he was without constitutional symptoms.

In August, 1919, he became acutely ill and coughed up large amounts of somewhat foul pus. There was no pus in the pleural cavity as demonstrated by exploratory puncture, though after four weeks the sinus opened and for a short time there was a moderate discharge. The sinus closed, the pus expectoration ceased, and in December an X-ray showed the lung expanded to fill almost the entire chest. There was a recurrence of purulent expectoration in January. At this time the X-ray and the physical signs demonstrated a cavity in the middle of the left lung posteriorly. The expectoration subsided in three or four weeks, and in April an X-ray and the physical examination failed to demonstrate any cavity formation.

The course of the disease in this case seems to have been an abscess, probably following the tonsillectomy, which ruptured into the pleura, producing the empyema. This was operated upon and the opening closed, but the lung failed to expand because of the internal pulmonary fistula which kept up a continued pneumothorax. This condition is evidenced by the fact that the chest wall instead of retracting, as is usual with a collapsed lung, expanded to a marked degree, as is amply illustrated in the X-ray by the wide separation of the ribs, a finding called to my attention by Dr. Codman, of Boston.

Subsequently the abscess discharged through the trachea, its fistulous opening closed, and gradually the lung expanded to its full extent with a resulting cure of the complex lesion.

The infecting organism in this case was found in every instance to be the streptococcus hæmolyticus.

This analysis of these pathological and clinical observations is believed to fully justify the findings included in the introductory remarks, namely, that the pneumococcus is not an important factor in lung abscess; that the staphylococcus aureus is often responsible; that abscess of the lung frequently is a primary lesion in that a true pneumonic consolidation as connoted by the name pneumonia does not precede it; that abscess of the lung includes in its pathology a marked degree of surrounding necrosis, or even massive gangrene, and that when an empyema ruptures into the lung and discharges through the bronchus the original lesion was a lung abscess which, by its extension, finally found two outlets for its purulent content.

THE MANAGEMENT OF TOXIC GOITRE FROM THE SURGICAL POINT OF VIEW*

By Charles H. Frazier, M.D.
of Philadelphia, Pa.

In a recent contribution to a current periodical the relative merits of X-ray and surgical treatment are presented from a series of cases, the mortality of which was about 15 per cent. A mortality so high, either after X-rays or operation, seems prohibitive, and the conclusions therefore negligible. So much thought and labor has been given in recent years to safeguarding the patient in the management of toxic goitre that we have a right to expect a better showing. As a matter of fact, surgery to-day is not only the safest but the most effective way of saving life and restoring health. In my own clinic during the past five years, the mortality after resection for toxic goitre was only 1 per cent. and a fraction. My experience with the pathological lesion of the thyroid includes a series of 339 cases which form the basis of these remarks.

The absorbing interest of the thyroid gland has aroused inquiry in the minds of many. From the laboratories, the internists and the surgeons there is a continuous output of contributions, of greater or less moment, in mass indicating the widespread interest in the many-sided aspects of thyroid disease. As most entertaining, though chiefly of historical value, is the "Operative Story of Goitre," by Halstead. Here is recorded Gross' point of view as to the propriety of removing a goitre. About half a century ago he wrote, "Every step he takes will be environed with difficulty, every stroke of his knife will be followed by a torrent of blood, and lucky will it be for him if his victim live long enough to enable him to finish his horrible butchery. Thus, whether we view this operation in relation to the difficulties which must necessarily attend its resection, or with reference to the severity of the subsequent inflammation, it is equally deserving of rebuke and condemnation. No honest and sensible surgeon, it seems to me, would ever engage in it."

What a transformation there has been from this picture of butchery to the refined technic of the modern thyroidectomy!

The interrelationship between the thyroid and the adrenals has long been recognized. In differentiating between the sympathetic and vagus hypertonic types of hyperthyroidism, Kostling (Grenzgebiete 21, 1910) a number of years ago considered an adrenalinæmia as the most important sign of the former and called attention to the dilatation of the iris on the installation of adrenalin. More recently Goetsch has recommended the test as a point in diagnosis in the border-line cases, cases resembling in some respects true

* Read at the Conjoint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 2, 1920.

hyperthyroidism, but without definite recognizable signs. Did this test prove infallible, we would have a valuable guide in the selection of cases for operation in this borderline group. I welcomed it as such, for in a certain number of instances, with but trifling enlargement of the gland, but without a clear picture of hyperthyroidism, I have been in a quandary as to the propriety of operating. I have applied the test routinely during the past few months, but have found it yet of little aid, and my skepticism has been aroused by negative reactions even in a typical exophthalmic syndrome.

To me one of the most practical problems of the surgery of toxic goitre is the determination of the degree of toxicity. This has a practical bearing upon the choice of operation. Kocher (*British Medical Journal*, Oct. 1, 1910) told us ten years ago that in the blood picture we had a very important aid as to prognosis and laid emphasis especially upon the relative increase in the lymphocytosis, he looked upon the degree of lymphocytosis as an evidence of the degree of toxicity. While it is quite true that, as a rule, the degree of the lymphocytosis bears a relationship to the gravity of the case, I have not found it by any means a constant guide as to the operative risks or as to the tolerance of the patient to surgical therapy.

What may prove to be a more dependable objective test is the determination of the basal metabolism, and the new Benedict apparatus, which we have installed as part of our equipment, has simplified this method of determination to a considerable degree. The estimation of the basal metabolism is, however, of more importance as a means of differential diagnosis in cases of obscure clinical picture with thyroid enlargement. In one of my series there was a great deal of doubt as to the relationship between the enlarged gland and a train of symptoms that were by no means typical. In this case the metabolism was not above but subnormal, so that an operation not only would have given no relief but would have been distinctly harmful. Metabolic studies serve the useful purpose, therefore, of enabling one to make a fairly accurate differential diagnosis between true hyperthyroidism and, for example, simple neurasthenia.

Means and Aub (*Arch. Int. Med.*, Dec., 1919) make the significant statement that for the most part patients with goitres, but without clinical signs of thyrotoxicosis, not only have a normal metabolism but that such cases do not subsequently become toxic.

Studies of the basal metabolism, I believe, should be made routinely in all cases of hyperthyroidism or for that matter of hypothyroidism, with just the same regularity as one should take the white-cell count in appendicitis or examine the urine in diabetes. This is true not only because of its value in differential diagnosis but because of the parallelism between the other signs of toxicity and the basal metabolism. For example, in the cases which clinically I would regard as severe, I find the basal metabolism runs something like this: plus 66, 78, 74, 68, 80, 73, 81, 93, etc., while of those cases of moderate severity it varies from plus 45 to plus 65 and the mild cases run below 45. To this statement it should be remembered, however, there are

noted exceptions and for this reason particularly one must still hold somewhat in abeyance the evaluation we are to place upon these metabolic studies in the management of new cases. For example, two patients with precisely the same metabolic rate may not be equally good surgical risks. Occasionally one sees a patient with a high metabolic rate with an unusually good tolerance to operation and vice versa. Again, a patient with a given metabolic rate may at different times be a good or a bad surgical risk. I have not been able to demonstrate that the metabolic rate always increases *pari passu* with exacerbations or crises. For these and other reasons the composite picture must be our guide as to what shall be our plan of action. Careful observation of each patient for at least a week, and two weeks, preferably, with attention to the cardiovascular symptoms, the vasomotor disturbances, the nervous and mental instability, in association with the blood picture and metabolic studies, will give us often much more satisfying and dependable data than any single objective test.

For practical purposes elaborate classifications of the toxic cases is unessential. The toxic adenomata may present operative problems quite as grave as those of hyperplastic type. Some of the most serious cases with which I have had to deal have been of the adenomatous group, with high metabolic rates and profound disturbances of the myocardium, cardiac rhythm and function, and while the technical difficulties of resection are not as great as with the toxic hyperplasias, the patients require just as much attention in the preliminary treatment and after-care.

Every available agency must be called into play in the nursing of these patients back to health. Rest, of course, is helpful in the preparation of patients for operation, but of itself will reduce the basal metabolism from only 10 to 15 per cent. Even this slight improvement should be taken advantage of. With hydrobromate of quinine I have had no demonstrable results and I was interested in the observation (Means and Aub) that the effect of rest plus hydrobromate of quinine had no more influence on the basal metabolism than rest alone.

In the extremely toxic cases I always prescribe X-ray treatments, but the results have not been altogether satisfactory. It is in those cases in which there is the slightest suspicion of an enlarged thymus that irradiation should be employed. There is not the least doubt that an enlarged thymus is responsible for many of the sudden deaths following operation and irradiation should be prescribed and practised in all such cases preliminary to operation.

With regard to the X-rays therapeutics in general, all the reports which I have seen deal in generalities and do not give in detail the end results. The writers of these reports would lead us to believe that the results are almost uniformly good and one would infer better than the results of surgery. The insinuation is made also that X-ray therapy is without danger in itself. To this, however, I take exception; in the first place, Holmes and Merrill (*Journal A. M. A.*, 73, 1963, 1919) tell us that the gland may be destroyed and a state of hyperthyroidism produced if the treatment is pushed too fast

The changes go on in the gland some time after treatment is discontinued. Secondly, the toxæmia may be increased to a dangerous degree by the first treatment and cases have been recorded (Secher) where the reaction following Röntgen therapy has been fatal. Thirdly, the increase in connective tissue makes subsequent operation more difficult.

The problem uppermost in our minds to-night is the surgical treatment. There can be no doubt as to the propriety of operation; the results are too striking to place the surgeon in a defensive attitude. It is a question only under what circumstances and by what method one shall proceed. That surgical procedure shall not be brought into disrepute, we should avoid certain pitfalls, and among these I would mention first of all the neurasthenias with enlarged glands between which there is no relationship of cause and effect. Fortunately the differentiation can now be demonstrated by objective tests. In the second class I would place the mildly toxic cases of adolescence, for here we have a physiological enlargement and the need of the economy is not less thyroid tissue in most instances but more iodine.

The third group among the undesirable include the thymic cases, and I have already referred to the necessity of preliminary X-ray treatment; in the fourth group I would place the wreckage, the cases in the terminal stage of the disease, the utterly hopeless cases; and in the fifth group the cases of hypothyroidism. I will not elaborate upon these several groups. Their recognition implies often careful, intensive study, but if our records of surgical achievement are to be above criticism, those groups should not be included among our operable cases.

In recommending operation shall we discriminate between the mild, moderate and severe cases? In the very mild cases, operation is not urgent; by change of occupation and other simple remedies (the care of teeth infection, the removal of infected tonsils and the like) there may be some improvement. But even without improvement, if the condition remains stationary and does not handicap the patient, operation remains one of choice rather than of necessity. But in the moderate cases I have always urged operation, because these are on the threshold of a condition that must always be considered potentially grave. There is no doubt at all that a certain percentage of cases recover spontaneously; nor is there any doubt that a certain percentage are improved or recover by what is called medical treatment, essentially rest; but it is equally true that these are subject to recurrences or relapses, and, whether the patient has been under medical treatment or not treated at all, every crisis of hyperthyroidism through which the patient passes leaves that patient a poorer surgical risk. This point must always be borne in mind by those who advise a "course of medical treatment." The degenerative changes, which take place in the vital organs during the period of procrastination, are permanent and preclude the ultimate and complete recovery of the patient. For these reasons, therefore, I take a firm stand as to the propriety of early operation.

Whether to begin the operative treatment with a resection or with a preliminary ligation, I think admits of no discussion. It has been my practice to resort to preliminary ligation when there is the least doubt as to the propriety of a resection, and as time goes on I find the number of preliminary ligations is increasing rather than decreasing and single ligation I prefer to double ligation at one or two weeks' intervals. As a rule, with a metabolic rate over 60, I always practice preliminary ligation, and in cases of lower metabolic rate when the other signs of great toxicity are evident in the rapid pulse, much loss of weight, restlessness, sleeplessness, and particularly marked vasomotor disturbances. The operation is performed in the patient's room, and according to our "anoci" technic the patient does not know that she has had more than an unusually severe "inhalation" treatment. I believe there are sound anatomical reasons for selecting the superior pole and I always surround the pole with two ligatures and divide all the tissues between, which includes thyroid tissue, cervical sympathetic fibres, lymphatic vessels, in addition to the arteries, that is the main trunk and its posterior branch.

There is but one objection, and only one, to preliminary ligation, and that is the additional scars. But the greater safety far outweighs any consideration of cosmetics. To make the scars less conspicuous, I place them always in a crease in the neck. Almost invariably one of two creases will be found near enough to the level of the pole to answer our purpose, and if the incision follows the crease accurately the scar will be quite inconspicuous.

I need not dwell upon the improvement after ligation, as you know in most cases it is striking as to pulse-rate, weight, basal metabolism and other indices of improvement. There is but one point that should be emphasized in this connection. The resection should follow at an interval of not more than two or three months. The maximum improvement is noted about that time and there may, and in most cases will be, relapses as the compensatory circulation increases in volume. In a few cases the patient may feel so much better that she or he will not return. This is a risk one takes in the practice of ligation. In some the improvement will not be so apparent, but as the vascularity of the gland has been appreciably diminished, the final operation will be attended with less bleeding. The difference in degree of improvement is difficult to account for, except perhaps on an anatomical basis, since the four arteries are subject to considerable and frequent variation. The superior arteries may both be very small, the inferior correspondingly large or vice versa. Whatever the explanation, I find great variations in the results. In the exceptional case the condition may be temporarily aggravated as in a recent observation where the metabolism rose from 49 to 66 after a single ligation.

But even though the preliminary ligation may not have been followed by as much improvement as had been anticipated, this step in the management of goitre serves a useful purpose. The reaction of the patient to the minor procedure is a very good index of the degree of reaction that may be anticipated after the final thyroidectomy. In some instances the thyroidectomy,

if the reaction is slight, may be performed two weeks rather than two months after the ligation.

The ultimate and total result of surgical interference follows the resection of the gland. In the preparation of the patient our "anoci" technic following the principles of Crile is strictly observed without variation. It matters not by what seductive method the gland is "stolen," the advantages of the principles involved cannot be overestimated, and with a trained staff of assistants and nurses the patient need not know the gland has been removed until she returns home. The measure of success in the surgical treatment of hyperthyroidism is in direct proportion to the amount of tissue removed. The incomplete or partial relief of symptoms, the relapses or recurrences must be charged to the failure to remove enough tissue. The resection should be bilateral even though the pathology seems confined to one lobe. I have never removed too much and more than once in earlier days too little. At least symptomatically there have been no instances of myxœdema, although in one instance the basal metabolism was minus. It is difficult to express in figures what proportion of tissue should be removed; some say four-fifths, some five-sixths. This, I believe, is too much if based on the size of the lobes with their pathological accession. If one leaves a thin layer of thyroid tissue, lining that portion of the capsule which remains after resection, there will be quite enough for the body economy. All operations are performed under nitrous oxide anæsthesia. According to our technic and to our conception of the advantages of the control of psychic influences local anæsthesia is distinctly contra-indicated.

In the final analysis the value of the surgical treatment of the toxic goitre must be estimated in terms of end results. The mortality now is far below that of any other method of treatment and each year the mortality is lowered. As for the end results, I have not been able to review my entire series, but in the analysis made before the war 80 per cent. of the patients heard from were recorded as recovered, either altogether or sufficiently to enable them to resume their occupations. The degree of recovery, be it remembered, must depend upon whether at the time of operation the ravages of the disease had damaged beyond repair the vital organs.

LATE RESULTS AFTER THE RADICAL OPERATION FOR CANCER OF THE BREAST*

By Willy Meyer, M.D.
of New York, N. Y.

Last fall, when preparing the data for a clinic I intended to hold during the Congress of American Surgeons in this city (October, 1919) on late results of operation for the radical cure of cancer of the breast, I tried to reach all my former ward patients, but soon was obliged to give up the efforts in this direction. It proved absolutely impossible—with the ever-shifting population of a large city like New York—to trace the patients operated upon in the wards.

This experience again impressed me with the great desirability, nay, necessity, of the "Follow-up System" so auspiciously inaugurated by a number of large hospitals in our country.

Under the circumstances I was obliged to content myself with the data available from my private patients, whom I had personally followed up for the last twenty-six years.

Two radical operations have been before the profession since the fall of 1894. Their principal point of difference is the direction in which the surgeon proceeds. The one method starts from the chest and works toward the axilla, leaving the clavicular portion of the pectoralis major behind; it requires entering the space between pectoralis major and minor muscles; the latter usually is divided and then sutured. As a matter of necessity this method involves quite some loss of blood.

The other method, which I have practised since September 12, 1894, starts from the axilla and works toward the sternum. The tendons of pectoralis major and minor are divided in the early stage of the operation, necessitating complete excision of both muscles. Blood- and lymph-vessels are primarily divided within the axilla. The lymph-nodes and axillary fat are lifted out in connection with the tumor, before the cancerous breast itself is handled. The entire mass is removed without entering what I call the "infected area." Hemorrhage is reduced to a minimum.

The final results of the operation from the sternum toward the shoulder, as reported, have been good. Still small cancerous glands have repeatedly been found between pectoralis major and minor muscle, and where cancerous lymphatic glands have developed there must be present suspicious lymphatic vessels. I feel that it must be better for

* Remarks made at the Joint Meeting of the New York Surgical Society and Philadelphia Academy of Surgery, February 3, 1920, and before the Surgical Section of the New York Academy of Medicine, April 2, 1920.

the patient if the space between the two muscles is not entered and the entire diseased area is excised in its normal anatomical relation.

Previous to 1894 excision of the breast for carcinoma was at last done in two stages, but at the same sitting, first, the removal of the breast with axillary contents; then the excision of the pectoralis major muscle. This arrangement forced the surgeon to widely enter "the infected area" and caused an unnecessarily great loss of blood. Personally, I did not see a single lasting cure after this mode of advance. The radical operation changed the results with one stroke. Most forcibly was this brought home to me by comparison of my personal statistics before and after September, 1894. The first two cases subjected to the modern radical operation were completely cured, and Case IV of this series had enjoyed freedom from cancerous recurrence for many years when she died of old age.

The following personal cases are alive and well to-day, from twelve to twenty-five and one-half years after operation:

Case I.—Operated upon September 12, 1894, when thirty-eight years of age (now a lady sixty-four years old). It is the first case operated upon by the method outlined above. She is alive and well to-day, twenty-five and one-half years after operation (Fig. 1).

Case II.—Operation done in 1895, at the age of forty-eight years (now a lady seventy-three and one-half years old). The patient is alive and well to-day, twenty-five years after operation (Fig. 2).

Case III.—Operation in July, 1902, when thirty-three years old (now a lady of fifty-one years). Patient alive and well to-day, eighteen years after operation (Fig. 3).

Case IV.—Operation in December, 1903, at the age of thirty-six years (now a lady of fifty-three), perfectly healthy and free from recurrence to-day, seventeen years after operation (Fig. 4).

Case V.—Operation in July, 1908, at the age of thirty-five years (now a lady of forty-seven years of age), perfectly healthy to-day, twelve years after operation (Fig. 5).

All patients have the full use of their arm, and are able to assume the posture of the "Statue of Liberty."

Case VI (Fig. 6).—Operated upon in September, 1917; is added merely to show the present line of incision with Handley's addition down to a point midway between umbilicus and xiphoid process, for the excision of the fascia covering the upper portion of the recti muscles, in conjunction with the other mass. I consider this addition decidedly recommendable, because it makes the operation more radical and usually enables us to close the wound without grafting.

Five other cases have remained free from recurrence for four, six, eight (2), and sixteen years, respectively, and then died of other diseases.

Another patient, a pronounced diabetic at the time of operation, was well for six years after the same when she succumbed to the diabetes, without having developed any signs of a recurrence of cancer.

Still another patient, operated upon for cancer of the right breast in March, 1899, returned to me in December, 1900, with a carcinoma of the left breast, which I then also extirpated. She was well and free from recurrence when last heard from, in the spring of 1907, six and one-quarter years after the second operation.

A few days ago, I met a lady, now almost eighty years old, in perfect health, who had been operated upon by me for a scirrhus of the breast at the age of seventy-three years (seven years ago).

These results, to my mind, prove the efficiency of the method; they prove that the *radical operation for cancer of the breast can cure* patients thus afflicted. If not all cases are saved, this is due:

1. To the stage of the disease in which the patients reach the surgeon;
2. To the virulence of the agent that produces carcinoma.

Paget's Disease (*Epithelioma of the Nipple*).—In this connection I will not fail to say a few words regarding Paget's disease, this most malignant of all cancers of the breast known to us. If ever early and radical operation is imperative, it is in these cases, as will be seen from the following three observations which I made in the last two years.

Case I.—Female, aged thirty years, mother of five children, had been in the hands of a quack and had been treated by caustics. When I saw her in January, 1918, the disease in the breast and axilla had far advanced. After the radical operation, the other breast soon became affected and, one year later, also was excised. Then, not long after, the disease became disseminated and she died from cancer en cuirasse.

Case II.—Female, aged thirty-eight years, had been in the hands of one of our best X-ray specialists in the city. One and a half years after the cure of the nipple by radium treatment there was a local recurrence and a very extensive cancer of the breast with infected glands in the axilla and along the subclavian vein. Radical operation, done by me December, 1918, followed by renewed X-ray and radium treatment. She now has developed intrathoracic metastases.

Case III.—Male, aged forty-five years. He had been in the hands of an experienced surgeon who had extirpated the breast only, without axillary glands, evidently because none could be found at that time. One and three-quarter years later the patient presented a far-advanced carcinoma. The radical operation then performed could not save him; he died from general metastases eight months later.

In operating upon mammary carcinoma, I make it a point to circumcise the skin widely at the base of the breast. I prepare two ample flaps and enfold them extensively, then divide the fasciæ at the base of the two flaps and extirpate them together with the mass.

I do not think that involvement of the supraclavicular glands presents a contra-indication to operation; on the contrary, I consider it the

surgeon's duty to operate when these glands are infected. Halsted, as well as the late Rodman, also Perthes abroad, have observed cases that remained well for a number of years after the extirpation of these glands.

In none of the cases who have remained well from twelve to twenty-five and one-half years after operation, were the supraclavicular glands found infected at the time of the operation, and, hence, they were not removed.

Personally, I have not operated upon a single case in which there were no infiltrated axillary glands.

As I have stated in a previous paper, to my mind statistics regarding the results of the radical operation for cancer of the breast are worthless. They do not prove anything. What *does* determine the fate of the patients is the so-called virulence of the disease. One and the same surgeon may do an equally radical operation in two seemingly early or apparently equally far-advanced cases; and one may remain well and free from recurrence for, say, twenty-five years, while the other may develop a regional recurrence and metastases within a few months.

All we can say is that cancer, being a local disease in the beginning, may be cured by radical operation if done at an early stage.

STATED MEETING, HELD MARCH 1, 1920

The President, Dr. George Ross, in the Chair

INTRA-ABDOMINAL HEMORRHAGE FROM RUPTURED CORPUS LUTEUM

Dr. John Speese reported the history of a woman, aged twenty years, who was admitted to the Presbyterian Hospital September 1, 1919, complaining of severe abdominal pain and vomiting. The attack began August 31, 1919, at 11 P.M., was sudden in its outset, the pain was localized to the right side in the beginning, but later extended over the entire abdomen, and at the time of admission was again localized in the right iliac fossa. Vomiting occurred after taking some medicine, bowels have been regular, no diarrhœa. Patient says she had a similar attack eighteen months ago.

Menstruation regular and normal, and the last period twenty-two days ago. Patient has been married for two years, has had no children and no miscarriages. Vaginal examination was negative. Leucocytic count 18,850. On opening the abdomen a large quantity of fresh blood was found free in the abdominal cavity, and large clots in the pelvis, the picture being that of a ruptured ectopic pregnancy. The right ovary was enlarged and on examination a point of rupture was noted, from the torn edge of which a constant but small stream of blood escaped, the hemorrhage evidently coming from a small vein. The tube appeared normal, as did the opposite tube and ovary. The ruptured ovary and the appendix, which was the seat of a chronic lesion, were removed.

The patient made an uninterrupted recovery, convalescence being delayed by the secondary anæmia (hæmoglobin, 40 per cent.; red blood count, 2,520,000), which responded rapidly to medical treatment.

Pathological Examination.—The ovary of normal size has on its superior surface an irregular ragged opening which measures 3 by 1.5 cm. The rupture involves almost the entire surface except 1 cm., where the ovarian tissue appears normal. Sections taken from the edges and base of the torn area reveal the usual picture of a corpus luteum and no evidence of the existence of pregnancy.

At the time of operation the condition was regarded as an ovarian pregnancy, but careful microscopic study of the specimen failed to show this condition. The case must, therefore, be classified as one of ovarian hemorrhage following rupture of a corpus luteum. Bovee (Gynecologi-

cal Transactions, 1918, xliii, 76) has studied exhaustively the subject of tubal and ovarian hemorrhage, and states that hemorrhage from the ovary may be confined within the ovary, constituting one or more hæmatoma, or it may take place into the peritoneal cavity, producing, if abundant, a hæmatocele. In the former variety it may occur in the stroma, into new growths, or into follicles in any stage of development. If before or during follicular hemorrhage rupture of the follicle or of the wall about a stromal active hemorrhage occurs, the peritoneum may be deluged.

The majority of cases occur during or within a few days of the menstrual period, and the changes in the ovary at this time are in all probability the most important predisposing factors. While various varieties of hemorrhage may take place in the ovary, hemorrhage from the corpus luteum, with resulting intraperitoneal hæmatocele, seems so simple and easy that Bovee wonders that it is recognized so infrequently.

The case reported follows the usual history of these instances of ovarian hemorrhage due to rupture of a corpus luteum, the rupture occurring six days before the menstrual period, was not preceded by any trauma or strain. The symptoms were not characteristic, and resembled those of appendicitis. In view of a previous attack, the absence of shock and a negative menstrual history, this diagnosis was made and perhaps not enough attention directed to the slight degree of pallor present, and only a leucocytic count made before operation. The presence of hemorrhage was not discovered until operation, which fortunately was performed immediately after admission to the hospital.

FECAL FISTULÆ WITH MULTIPLE JOINT INFECTION

Dr. Arthur E. Billings reported the history of a boy, aged five years, who was referred by Doctor Niles, of Carbondale, Pa., July 19, 1919, to the service of Doctor Gibbon at the Jefferson Hospital.

His chief complaint was profusely discharging fecal fistulæ in the right lower abdominal quadrant. He had been operated upon three years before for an appendiceal abscess, and a short time after this he was operated upon a second time for the closure of a fecal fistula which developed soon after the appendix operation. He was then seen by Doctor Niles who found multiple openings on examination, and tried to close the fistulæ by suture without resection, but the attempt was unsuccessful. The patient's mother stated that he had not had a normal bowel movement for nearly three years, all fecal discharge occurring through the fistulous openings in the abdominal wall.

Physical examination did not reveal anything abnormal except in the abdomen. He was a little small for his age, but was fairly well nourished. The abdomen was not distended or tender except in the region of the old scars and the four fistulous openings which occupied most of the right lower quadrant. The two smaller openings were external and the two

larger ones were on the inner side of a rather long oblique incision which extended almost to the midline just above the pubis. There was marked eversion of mucous membrane about all the openings, particularly the larger two, either of which would admit one or two fingers.

Doctor Manges demonstrated by fluoroscopic and skiagraphic examination after barium meal, barium enemata and injection of barium through the fistulæ, that the two outer openings were in the cæcum and the two larger ones were in the descending colon or sigmoid; one filling the segment of colon above and the other the sigmoid and rectum.

The urine was negative on admission and subsequently, except for a trace of albumin and a few hyaline casts immediately after operation. There was no leucocytosis, and the temperature was practically normal (running up to 99.3 on two or three occasions) from the time of admission to operation August 4, 1919; during which time there had not been any discharge of fæces by rectum.

The patient was anæsthetized with chloride of ethyl and ether. The abdomen was cleaned with benzine and the fistulous openings were closed with continuous sutures to prevent leakage during operation. The field was again cleaned with benzine and then painted with tincture of iodine. An oblique elliptical excision of the fistulous openings was then made in line with the old scar. As the abdomen was opened and the adherent intestines separated the peritoneal cavity was protected with gauze packs. The cæcum was separated from the mass and the two openings which were on the anterior and inner surfaces were closed with a series of inverting chromic catgut sutures. The other two openings, which were found to be due to a complete division of the sigmoid down to its mesentery, were closed, after separating and freshening its ends, by doing an end-to-end anastomosis with a double suture line of chromic catgut. The abdomen was closed with considerable difficulty (because of loss of tissue and scar formation) around two rubber-covered gauze drains. The patient was in fairly good condition at the end of the operation. On the second day after operation his temperature went to 102° and his pulse to 170 with evidence of a good deal of infection in and about the wound, without vomiting or much distention. His pulse-rate by the third day had dropped to between 100 and 120 with a temperature a little above 100°. By this time there was considerable purulent discharge from the wound which was characteristic of a colon bacillus infection. His temperature was not quite normal until seventeen days after operation. The wound was discharging pus freely, but had discharged very little, if any, fecal matter. On September 25th his temperature rose to 102° with pain about the right knee-joint; and in forty-eight hours both knees were swollen and distended with fluid, but not very tender. Leucocytes, 7200. There was no redness or heat about either joint. Temperature on October 1st, six days after onset of pain, was normal. A few days later the left and right ankles were successively involved with less acute signs than were mani-

fested in the knee-joints. The temperature continued irregularly then for the next two months between normal and 100°.

With considerable periarticular thickening about all of the joints involved, X-ray showed cloudy distention of both knee-joints without evidence of bone involvement. Otherwise all were negative. All of the involved joints were fixed with splints and saturated solution magnesium sulphate dressings with ice-bags were applied until all acute symptoms had subsided. The abdominal wound had healed except superficially where there had been considerable skin separation. Blood culture was negative on September 30th, and the leucocyte count was not recorded above 9500.

The patient was discharged with good joint function, but with definite thickening about all of the involved joints, more particularly in the knees. None of the joints were aspirated and there is no positive evidence that there was a direct connection between the abdominal and joint infections, although this probably was the case.

Dr. A. Bruce Gill thought it very possible that there was a connection between the abdominal infection and the infection of the joints. He thought colon infection of joints to be rather common. He recalled the case of a boy who came up from North Carolina to the Presbyterian Hospital whom he saw in consultation with Doctor Wharton. The boy gave a history that about a week previous to an acute onset of arthritis of the knees he had a severe intestinal disturbance, which began with a sudden fainting attack and continued with fairly high fever. After the onset of the arthritis he was treated at home for a while for rheumatism, and was then brought to Philadelphia as he was showing no improvement. A culture of a sterile catheterized specimen of urine was made and it was found to contain a colon bacillus in pure culture. An autogenous vaccine was administered, and the patient showed rather rapid recovery. He left the hospital a few weeks later almost completely cured.

On several other occasions in cases of chronic arthritis he had found a pure colon infection of the urine. One writer, whose name he did not recall, believes that in cases of focal infection anywhere in the body the microörganism which causes the infection can usually be recovered in the urine. While this does not prove that the arthritis is due to the colon infection, it is at least suggestive. Arthritis which is due to colon bacillus infection frequently runs a rather mild course and recovers without any sequelæ. He thought it likely that many cases of chronic hypertrophic arthritis are due to colon bacillus infection.

THE RELATIVE VALUES OF RADIUM AND SURGERY IN THE TREATMENT OF TUMORS OF THE PELVIC ORGANS

Dr. John G. Clark then pronounced the annual oration before the Academy, for which see page 81.

John H. Gibbon said that it was an inspiration to observe the work

which has been done in the Memorial Hospital in New York, for instance, by the coördinated work of surgeon, röntgenologist, and pathologist. He was persuaded that the time is coming when surgeons will probably not operate in cases of cancer of the cervix, in certain cancers of the mucous membrane, and cancer of the tongue. Cancer of the tongue is extremely difficult to cure by operation alone, and he believed that it will soon be shown that better results are obtainable by the use of radium.

He protested against operation in far advanced and in inoperable cancer, and also in those cases where metastasis had already occurred. Operation in these cases is a sad commentary on surgical judgment. Such operations only confirm in the minds of the laity an idea that is already prevalent, that surgery is of no avail in cancer. Every such patient operated upon is educating the public in the wrong way. It is far better to decline to operate, allowing it to be understood that relief through surgery was sought too late.

Dr. E. E. Montgomery approved the stand taken by Doctor Clark. The radium is not to be applied in the larger growths and particularly in those where there are complications. It occurs not unfrequently in fibroid tumors that the growths in order to adapt themselves to the configuration of the pelvis cause more or less twisting of the organ, which torsion affects first the venous circulation, because of the less resistance of the veins. The firmer arteries permit blood to be pumped in and the growth rapidly enlarges, vessels rupture and fill with blood, or it escapes into the abdominal cavity. A hæmatoma may thus be formed in both ovaries. The employment of radium in such cases would seem provocative of trouble rather than affording relief. He operated yesterday upon a woman who had a number of fibroids in her uterus. When the abdomen was opened evidences of free blood almost equal to those seen in ruptured ectopic gestation were seen. The situation of the tumors had led to torsion and rupture of the vessels in the ovaries and the presence of the hæmatoma.

In regard to carcinoma he had seen some remarkable results from radium in recurrences following operative procedures. The disease would clear up and for two or three years there would be entire freedom of any sign of the disorder. When it did recur it would be in deeper structures and free from the annoyance of the superficial disease. The cessation for a time was a demonstration of the great value of this agent. In some cases apparently non-operable, the action of radium seemingly brings about such change as to permit subsequent operation with apparently good results. Where, however, the limitations of the disease permit of operation in healthy tissue and the possibility of entire removal of affected tissue, the knife should be the method employed for its eradication.

In regard to apparently non-operative cases, he remembered a number where the cervix was so completely destroyed as to make it questionable to his mind whether operation should be resorted to, that have

lived fifteen, twenty, and twenty-five years following the removal of the uterus.

He had seen other cases, in which the disease was circumscribed and he felt that no hesitancy existed in promising a favorable result where operation was followed in a few months by recurrence in a virulent form rapidly ending fatally. Much is still to be learned of the character of cancer, the resistance of the patient, and the probabilities of its extension and recurrence. All know that when the disease occurs early in life, prior to the fortieth year, it is almost certain to recur even though the case undergoes early operation.

Dr. Henry K. Pancoast said that the results that Doctor Clark has gotten he did not think could be duplicated by every one. In the use of radium one has to command, first, common sense; secondly, a knowledge of physics; thirdly, a knowledge of gynæcology. All of these are absolutely essential. A great many men have been using radium in the treatment of gynæcological conditions and consider little beyond the gynæcological aspect of the cases, and their results will not be routinely promising as are to be expected in the judicious use of the radium. In the early days of radium therepy it was usually in the hands of röntgenologists. The use of radium belongs really to the gynæcologist and not to the röntgenologist, unless he is doing that work as a special line along with his röntgenology. Doctor Clark's results have been obtained after the most careful work and the most judicious use of the therapeutic agent he has employed.

THE CHLORINE ANTISEPTICS

Dr. W. Estell Lee read a paper with this title, for which see page 95.

Dr. John H. Gibbon emphasized the fact that this subject is just as important now as it was before the war was over, because as far as surgery goes it has been the greatest product of the war. He thought there could be no doubt that the treatment of infected wounds had been revolutionized by the war. He thought Doctor Lee's summary, for one who has been so enthusiastic about one of these preparations, to be a very just summary. He would question the destructive quality ascribed to the hypochlorite solution in fairly clean wounds, for the reason that he had seen it used so extensively in clean wounds without any clinical evidence, at least, of sloughing. The British injected "eusol" into joints and there was very little difference between what took place in those joints and what took place in joints where they used ether or salt solution. One of the most important things that Dakin did was to show that the majority of antiseptics that surgeons had been using for years were valueless because of the way they had been used. This is due to the loss of their germicidal qualities in a short time, due to contact with organisms and wound secretions. To pack a wound with gauze saturated with an antiseptic solution once a day is perfectly useless. In order to obtain

any benefit the antiseptic must be constantly applied. Carrel says: "If it be supposed that each microbe divides every half hour it will give birth in twelve hours to more than fifteen million other microbes." This idea of keeping up the bacteriocidal action of agents is one of the greatest things that has come out of the war. Another great advance is the mechanical sterilization of the wound. He was convinced that the conflicting reports about the various antiseptic agents that have been used—that is, one man claiming that Bipp, another that flavine, another that salt solution, another that hypochlorite is the only thing to use—is due to the fact that in the later months of the war the wounds did well because they were properly débrided, that they had undergone a proper mechanical sterilization, and not because of the employment of any agent. Therefore, it comes down to the question as to what can be done in the infected wounds, and here there has not been any antiseptic that is comparable to the chlorine group.

Dr. John H. Jopson making a comparison between the results obtained by the antiseptic treatment of infected wounds, and closure of the same after reduction of the bacterial content to a certain point, with fresh wounds containing a similar number of bacteria per field, said that one must bear in mind that there are certain factors to consider besides the count. It might be perfectly safe to close the first with a count of one in three fields, and not the second. There is no doubt that the virulence of a particular strain is often reduced by prolonged antiseptic treatment, at least in the same individual. Again, it is never safe to depend on count alone, as a differentiation of the infecting organisms is always necessary to exclude the futile and dangerous attempt to close over a streptococcus, however few in numbers it may be. Wherever a streptococcus has been found at any time, at least two cultures negative for that organism must be obtained at successive times before delayed primary or secondary suture is made.

A certain organism may acquire an immunity to one antiseptic after prolonged treatment, and succumb quickly to another. We have seen this exemplified in a stump in which prolonged Carreling had failed to eradicate a streptococcus, although the count was low, and the stump looked healthy. A very few applications of dichloramine-T sufficed to eliminate the streptococcus, and a successful secondary suture was done. If we agree with Carrel that the only external agents which can influence the time of healing are those making for sterility of the wound, it is evident that this acquired immunity is the explanation of the well-known clinical fact that occasional change in the manner of dressing granulating wounds is often of decided benefit.

Dr. F. O. Allen said that he did not think surgeons appreciated the value of dichloramine-T in the treatment of infections, such as boils, abscesses, broken-down glands, and so forth. He had followed Doctor Lee's work since he first began it and had become very much impressed

with the value of dichloramine-T in local infections, what might be called superficial infections. In any situation where there is a cavity filled with pus that can be thoroughly drained, even in large breast abscesses, packing with gauze saturated with dichloramine-T solution gives results far better than any other treatment he had ever seen. In almost all such instances the abscess cavity can be pretty thoroughly sterilized in one or two days, and after that it closes rapidly.

THE RELATIVE VALUES OF RADIUM AND SURGERY IN THE TREATMENT OF TUMORS OF THE PELVIC ORGANS*

By John G. Clark, M.D.
of Philadelphia, Pa.

The logically developed principles underlying the modern operations for myoma uteri with their large life-giving and health-restoring factors, and a percentage, though small, of cures after a radical operation for cancer of the cervix and the large salvage after hysterectomy for cancer of the fundus, place these surgical procedures upon a plane of efficiency that commands our admiration. Just as old wine requires no bush, so a perfect method which yields faultless results may stand without support as the product of a perfected art or science. The choice of my title, therefore, has been made with the intent of forestalling any suggestion of surgical nihilism, for I am convinced, as the result of five years' experience in the use of radium, that we may consider it as an adjunct of surgery and not its competitor. The fact, however, that radium has worked so well in certain types of myoma uteri and has rendered so much easier the life of patients afflicted with incurable cancer, and further, that among these cases it has a definite percentage of survivors to its credit over the three-year period, with two individuals who have passed the quinquennial test, makes its unnecessary to offer an apology for making this novel form of therapy the subject of this address. In other words, our experience is such as to sustain the belief that in this instance the vintage of the modern surgical wine, although excellent, does occasionally require fortification, for this remedy is a most effective surgical coefficient, which, however, does not supplant surgical intervention but merely aids us in developing a well-balanced judgment in the selection of those cases best fitted for the more radical measures and those adapted to the safer and easier therapy.

The results in cancer of the uterus from the most radical operation, when we consider the small percentage of operability and the very high ratio of recurrence, will not stimulate a very antagonistic discussion against any substitute which may offer encouragement for relief or pos-

* Annual oration before the Philadelphia Academy of Surgery, delivered March 1, 1920. This address comprises the general subject matter of other papers which have appeared from the Gynæcological Department of the University Hospital under the joint authorship of Dr. Floyd E. Keene and myself. The summary of cases includes only those treated in the University Hospital by Doctors Anspach, Norris, Keene, and myself.

sible cure of that large proportion of cases which fall within hopeless bounds so far as direct surgical intervention is concerned. On the other hand, as the proceedings of our various national societies attest, very strenuous opposition has arisen against radiation in myoma uteri. To the surgical enthusiast, this opposition is apparently well based, for during the last two decades the evolution of the operative treatment of this class of tumors has reached a plane of such scientific precision as to furnish the liveliest satisfaction, for the operations are attended by an exceedingly low mortality, and furnish a very large percentage of absolute cures and a small morbid residue. Our own experience in the Gynecological Department of the University Hospital very satisfactorily justifies our confidence in surgical intervention, for in our last series of 100 cases of myoma, in which hysterectomy has been performed during the last fifteen months, there was but 2 per cent. mortality, but notwithstanding this satisfactory issue, during that same interval, 110 cases have been radiated without mortality and almost without morbidity. We do not set one series of cases in antagonism to the other, but view both with equal satisfaction. The first represented the more hazardous risks, for it includes the large tumors and those associated with coincident inflammatory or other pathological lesions, whereas the second series comprise chiefly the small tumors causing hemorrhage and those cases of myopathic hemorrhage which in previous years have been subject to hysterectomy. To bring this question into clearer light for discussion, I shall consider, first, the use of radium in myoma uteri.

Myoma Uteri.—In the study of myomatous tumors, both in the consulting room, in the laboratory, and in the operating room, it has been fully attested that the symptomless tumor may remain quite innocuous over an indefinite period and finally after the menopause cease to be even a tentative menace, but the percentage of such cases is really very small in the final clinical summary of these cases. First, as to the various changes and degeneration which may take place in the tumor itself. Of these, the malignant change has probably been chiefly stressed as an argument in favor of attacking all growths of this nature as soon as diagnosed. That this fear has been enormously magnified has been proved in the study of over 850 cases in the gynæcological laboratory by my associate, Dr. Charles C. Norris. A small ratio, not greater than 4 per cent., of cancer of the fundus may be found among myomatous uteri, but it is seldom, indeed, that these cases are not diagnosticated with great assurance on first consultation before even a curettage is performed.

A myomatous tumor is a constructive growth, merely building up in a disorderly fashion the normal muscular and fibrous tissues of the uterus. Consequently, so far as uterine bleeding is concerned, and this is the chief symptom upon which we rest our diagnosis of benignancy, it follows the normal physiologic law of periodicity. Therefore, when the normal menstrual flow is converted into a menorrhagia, even though stretched over

several days, with clean-cut intermenstrual intervals of no bleeding or discharge, the clinical assumption in favor of benignancy is almost positive. On the other hand, cancer of the cervix or fundus is not of a constructive type of growth, but almost immediately shows a destructive activity in its earliest period of growth, and in creating its hemorrhagic symptoms deviates at once from the law of periodicity and begins to cause intermenstrual spotting, which very soon merges into a continuous flow with only the ebb and flood tide of the menstrual waves increasing and decreasing its output.

Almost with unerring precision, therefore, one may rule out cancer of the fundus except, in the earliest possible case through this interpretation of menstrual symptomatology. Menorrhagia is the hall mark of a myoma, regardless of its excess, whereas the tiny spot of intermenstrual blood is always a danger signal of cancer never to be considered carelessly. The criticism, therefore, that in treating myomata with radium, one may overlook cancer is not based upon clinical facts. Further, this error may be checked accurately by the diagnostic curettage, which should invariably take place in every case in which there is the slightest suspicion of this complication. Should the pathologic report show the presence of a coincident cancer of the fundus, a hysterectomy may be performed before the patient leaves the hospital. In such an event, the use of radium does not prejudice either the immediate surgical or remote curative result, for it has struck a very effective blow against the cancer, which combats its further distribution through metastasis, and especially serves when the hysterectomy is performed as a splendid prophylactic agent against the implantation of actively growing cells in the freshly exposed tissues. In its action, radium strikes immediately and effectively all carcinomatous cells within its radius and like stricken plants which may not wither for a few days are, nevertheless, rendered incapable of further growth or propagation.

Through selective differentiation as controlled by our laboratory findings in myomatous tumors, we are much more concerned by one or two of the benign retrogressive changes in myomata in their relations to radium therapy than by the malignant changes which may certainly be recognized and properly dealt with. A simple liquefaction process, or hyalin change, may be taken care of very satisfactorily by gradual absorption; a true necrosis, however, gives rise to toxic by-products, which seriously influence the patient's health.

One not infrequently finds in certain myomatous cases a degree of anæmia not balanced for by the loss of blood, the patient's complexion appearing more like that of cachexia than that which occurs in an uncomplicated anæmia; and furthermore, there is an asthenia of a toxic type which is not satisfactorily accounted for by a simple blood loss. Seldom, indeed, in such instances is a malignant condition encountered, but not infrequently varying stages of degeneration of the tumors are discovered on macroscopic section marked by a grayish-purple or slaty discoloration

sible cure of that large proportion of cases which fall within hopeless bounds so far as direct surgical intervention is concerned. On the other hand, as the proceedings of our various national societies attest, very strenuous opposition has arisen against radiation in myoma uteri. To the surgical enthusiast, this opposition is apparently well based, for during the last two decades the evolution of the operative treatment of this class of tumors has reached a plane of such scientific precision as to furnish the liveliest satisfaction, for the operations are attended by an exceedingly low mortality, and furnish a very large percentage of absolute cures and a small morbid residue. Our own experience in the Gynecological Department of the University Hospital very satisfactorily justifies our confidence in surgical intervention, for in our last series of 100 cases of myoma, in which hysterectomy has been performed during the last fifteen months, there was but 2 per cent. mortality, but notwithstanding this satisfactory issue, during that same interval, 110 cases have been radiated without mortality and almost without morbidity. We do not set one series of cases in antagonism to the other, but view both with equal satisfaction. The first represented the more hazardous risks, for it includes the large tumors and those associated with coincident inflammatory or other pathological lesions, whereas the second series comprise chiefly the small tumors causing hemorrhage and those cases of myopathic hemorrhage which in previous years have been subject to hysterectomy. To bring this question into clearer light for discussion, I shall consider, first, the use of radium in myoma uteri.

Myoma Uteri.—In the study of myomatous tumors, both in the consulting room, in the laboratory, and in the operating room, it has been fully attested that the symptomless tumor may remain quite innocuous over an indefinite period and finally after the menopause cease to be even a tentative menace, but the percentage of such cases is really very small in the final clinical summary of these cases. First, as to the various changes and degeneration which may take place in the tumor itself. Of these, the malignant change has probably been chiefly stressed as an argument in favor of attacking all growths of this nature as soon as diagnosed. That this fear has been enormously magnified has been proved in the study of over 850 cases in the gynæcological laboratory by my associate, Dr. Charles C. Norris. A small ratio, not greater than 4 per cent., of cancer of the fundus may be found among myomatous uteri, but it is seldom, indeed, that these cases are not diagnosticated with great assurance on first consultation before even a curettage is performed.

A myomatous tumor is a constructive growth, merely building up in a disorderly fashion the normal muscular and fibrous tissues of the uterus. Consequently, so far as uterine bleeding is concerned, and this is the chief symptom upon which we rest our diagnosis of benignancy, it follows the normal physiologic law of periodicity. Therefore, when the normal menstrual flow is converted into a menorrhagia, even though stretched over

several days, with clean-cut intermenstrual intervals of no bleeding or discharge, the clinical assumption in favor of benignancy is almost positive. On the other hand, cancer of the cervix or fundus is not of a constructive type of growth, but almost immediately shows a destructive activity in its earliest period of growth, and in creating its hemorrhagic symptoms deviates at once from the law of periodicity and begins to cause intermenstrual spotting, which very soon merges into a continuous flow with only the ebb and flood tide of the menstrual waves increasing and decreasing its output.

Almost with unerring precision, therefore, one may rule out cancer of the fundus except, in the earliest possible case through this interpretation of menstrual symptomatology. Menorrhagia is the hall mark of a myoma, regardless of its excess, whereas the tiny spot of intermenstrual blood is always a danger signal of cancer never to be considered carelessly. The criticism, therefore, that in treating myomata with radium, one may overlook cancer is not based upon clinical facts. Further, this error may be checked accurately by the diagnostic curettage, which should invariably take place in every case in which there is the slightest suspicion of this complication. Should the pathologic report show the presence of a coincident cancer of the fundus, a hysterectomy may be performed before the patient leaves the hospital. In such an event, the use of radium does not prejudice either the immediate surgical or remote curative result, for it has struck a very effective blow against the cancer, which combats its further distribution through metastasis, and especially serves when the hysterectomy is performed as a splendid prophylactic agent against the implantation of actively growing cells in the freshly exposed tissues. In its action, radium strikes immediately and effectively all carcinomatous cells within its radius and like stricken plants which may not wither for a few days are, nevertheless, rendered incapable of further growth or propagation.

Through selective differentiation as controlled by our laboratory findings in myomatous tumors, we are much more concerned by one or two of the benign retrogressive changes in myomata in their relations to radium therapy than by the malignant changes which may certainly be recognized and properly dealt with. A simple liquefaction process, or hyalin change, may be taken care of very satisfactorily by gradual absorption; a true necrosis, however, gives rise to toxic by-products, which seriously influence the patient's health.

One not infrequently finds in certain myomatous cases a degree of anæmia not balanced for by the loss of blood, the patient's complexion appearing more like that of cachexia than that which occurs in an uncomplicated anæmia; and furthermore, there is an asthenia of a toxic type which is not satisfactorily accounted for by a simple blood loss. Seldom, indeed, in such instances is a malignant condition encountered, but not infrequently varying stages of degeneration of the tumors are discovered on macroscopic section marked by a grayish-purple or slaty discoloration

or actual gangrene in some of the tumors, indicating a partial or complete necrosis. In others an extensive liquefaction necrosis is noted. Through the absorption of these necrotic or degenerating materials, serious inroads on the patient's constitution have occurred and a rapid healthful rebound follows a hysteromyomectomy. Based on these observations, we cannot look with favor on the conversion of large tumors through radiation into retrogressive tissues, which through absorption may cause toxic symptoms, hence our limitation based upon the smaller sizes of the tumors has been established. When the tumor is large, as we have hitherto noted, the patient may serve as the sarcophagus for her decadent tumor. Also, these large tumors are very frequently associated with or, through pressure, have produced other lesions, especially of the inflammatory class. Frequently pressure symptoms have forced the patient to consult the surgeon, and there may be no variation of the menses from the normal. In such cases the tumor may be a pure fibroid, largely of a dense hyaline or calcareous type, certainly not quickly responsive to radiation.

For these, and still other reasons, therefore, we find no evidence thus far in our experience to convince us that the large tumors should not be removed by approved surgical methods. In no instance has there been so quick a decrease in the size of even the smaller tumors as to justify us in believing that the larger tumors which are giving pressure symptoms will diminish sufficiently rapidly in even six months or a year to give satisfactory relief. We stand, therefore, on the general principle against radiation in tumors larger than a three or four months' pregnancy, and in only the exceptional case do we deviate from this rule.

The next danger—that of sarcomatous transformation of the myoma—is also stressed with much gravity by many writers, but the cold laboratory records very greatly chill this side of the discussion. The fact is that sarcoma is seldom a degenerative or concomitant evil of myoma. If it were as common as is asserted by some of these alarmists, out of every series of 100 supravaginal hysterectomies, as usually performed by American surgeons, a definite percentage of recurrent sarcomas in the cervical stump should be encountered. In more than 1000 hysterectomies performed in the Gynecologic Department of the University Hospital such a sequel of a supravaginal hysterectomy has been observed but once. In a review of 816 myomas in our laboratory by my associate, Dr. Charles C. Norris, he finds 25 sarcomas, only 13 of which were not diagnosed clinically at the time of operation. Based both on clinical and on laboratory conclusions, therefore, we deal with fears solely within the domain of fallacious supposition in discussing the dangers of sarcomatous changes in myomas and fibromas. Even were these fears justified in a much larger measure, there would still be no argument against the use of radium, since these tumors react most favorably to this influence.

Through an experience with nearly two hundred cases, including myomata chiefly and a smaller number of myopathic hemorrhage, we

have established for ourselves a very definite rule of elective procedure. As to the cases which we do not radiate, we may classify them as follows:

1. The larger tumors; as measured by the size of the pregnant uterus, the maximum being that of a three or four months' pregnancy. There are a few exceptions to this rule as marked ordinarily by decided surgical contraindications, such as grave heart lesions, greatly diminished renal function, and other serious constitutional defects which ordinarily render an operation unduly hazardous.

2. All tumors with symptoms of associated inflammatory lesions, indicated chiefly by unilateral or bilateral pain. This contraindication to radiation is based upon the fact that old inflammatory lesions may be stimulated into renewed and dangerous activity. In three or four instances, this distressing complication has followed radiation in these cases.

3. In patients with normal or slightly increased menstruation who present a cachectic appearance and are the subjects of toxic symptoms out of proportion to their anæmia.

4. In all cases in which there are symptoms of other coexistent abdominal lesions, such as cholecystitis, cholelithiasis, appendicitis, etc.

With these four classes still held within the surgical domain, we treat only the tumors of smaller sizes, causing hemorrhage as their chief symptom, and all cases of myopathic hemorrhage. Of all patients, the latter respond most quickly and satisfactorily to this remedy. Under the limitations just enumerated, we may with the greatest assurance predict a very satisfactory course for cases falling within the restricted domain. The great advantage of this plan of treatment over either X-ray treatment or major surgical operations is its simplicity and safety. The patient undergoes the simple preparation incident to a curettage. Nitrous oxide anæsthesia is administered, the cervix is well dilated, the uterus curetted if there are symptoms of possible malignant change, and fifty milligrams of radium introduced according to the method described in other papers hitherto published. The use of an anæsthetic makes more accurate the diagnosis and safer the application. The subsequent events in the recovery of the case follow with clock-like regularity; five days in the hospital, about six weeks of variability as to the flow, in some this symptom may persist or even temporarily be excessive, in others ceasing abruptly, never to recur. After the hemorrhagic phase is over, there is a brief period, as a rule not over ten weeks from the time of radiation, of a slight sticky yellowish vaginal discharge, seldom profuse and never offensive. This concludes the symptomatology as it relates to the uterus after radiation.

Menopause.—The change of life in these cases varies in its phases, as the constitutional and temperamental characteristics of women vary. In this connection one might employ the lines of the comic opera librettist: "There are never two women alike, and never one woman alike twice." In the more marked grades of anæmia we believe the climacteric change is

more abrupt and attended with more pronounced symptoms. This may be explained on the theory that the hematogenous system has been working for weeks or months at a great speed in corpuscular generation, since the continuous loss of blood is so great that this excessive deficit must constantly be remedied. A quick check on this great activity must in many instances jar the physiologic equilibrium and thus induce a more acute menopause. So far as we are able to judge, we believe that the menopause is somewhat more trying to the average woman under an abrupt cessation than when she drifts into this change more naturally. In estimating the possible objections to radiation this symptom may possibly be classed in this light, although it in no way differs from the same sequel after a hysterectomy in which the ovaries are removed. In general, we find our patients are very enthusiastic over their results, and count this possibly trying symptom as of light moment compared with their satisfaction over an escape from an operation.

Failure to Relieve.—Of our series of over 150 cases, we have failed to relieve four patients sufficiently to satisfy them or ourselves, and we have subsequently resorted to a hysterectomy. Two patients have been operated upon in other clinics. So far as we have seen, no disadvantage has occurred from the preliminary radiation, as all of the patients except one upon whom an operation has been performed have recovered without complications.

The course of events just depicted is that noted in women nearing or in the menopausal years. In younger women, we employ radium much less frequently than we operate, because these cases may be eligible for a simple myomectomy or a subtotal hysterectomy, which leaves the generative organs essentially normal in the first class, and there is a more stable physiologic equilibrium after an operation in the second. When we resort to radium in younger individuals, it is never employed in maximum dosage, but is started at a low point of intensity free from the danger of bringing on the climacterium. It may, therefore, require a second and possibly a slightly stronger dosage to check an excessive flow. In younger patients we study with particular care the symptomatology and its underlying pathology, for there is just as much danger in these individuals from the unbridled use of radium as that following the heedless surgery of the overzealous or injudicious ovariotomist. As a concluding comment upon this aspect of radiation, we may express the greatest enthusiasm as to the results obtained in a large series of cases, now over 200. Time is proving the cures permanent and free from any sequelæ, which in their later phases might stand prejudicially against the treatment.

Cancer of the Uterus.—From the beginning of our use of radium in the Gynæcological Department of the University Hospital in 1914 up to January, 1919, over one year ago, when our last summary was made by Doctor Keene and myself, we had treated 209 inoperable cases of cancer of the uterus with the following results:

	Dead	Not traced	Living
1914	8	0	1
1915	19	1	4
1916	46	8	11
1917	33	3	23
1918	5	13	34
Total	111	25	73

No cases treated within one year before this tabulation have been enumerated, as we are now looking towards the ultimate rather than immediate results. Since the above tabulation was made at least two of the patients treated in 1915 have gone over the five-year period and are living and free from recurrence.

We regret that we are unable at this stage of our report to give a more complete summary as the number of patients not traced is accounted for by the facts incident to war—first, the decreased number of our hospital staff rendering it impossible to keep our follow-up system abreast of the times. Further, the nomadic tendency of an urban population, due to the recent fluctuation of our industrial systems and the disturbance incident to the housing situation, makes it exceedingly difficult to keep track of a continuously mobilizing population. In endeavoring to trace our patients we have found not infrequently a change of three or more addresses within a few months after their discharge from the hospital. Notwithstanding these discrepancies in our reports, the showing in this series is rather remarkable, and we have been greatly encouraged to find so large a number of patients, all of whom fell within the inoperable class, still living and apparently well many months subsequent to their last treatment. Some of these cures have been startling, and we are now justified in our hopeful forecasts for a few permanent cures and we know beyond cavil that the palliative results have been far and away better than that following any therapeutic measure hitherto employed. In reviewing our results from radium therapy, we find that same bizarre tendency as noted in our previous surgical experience with cancer. From the appearance or even the extent of the disease no one can forecast with assurance the probable outcome of treatment. When surgical measures are invoked, one frequently ends an operation with a great degree of optimism as to a cure, because the disease has apparently been well circumscribed and has shown no demonstrable metastasis, and yet within a few months has again appeared with renewed violence at the local site of operation, while in another case in which the frontier zone of the growth has not satisfactorily been encompassed and the prognosis is bad, the patient may remain free a long time from recurrence or even may be cured. This same peculiarity has been noted in our radium experience. Thus in our 9 cases treated in 1914, the one living patient discredited every forecast and survives to-day and is to all appearances cured despite a very extensive and a very vicious type of cancer. A young woman

under thirty years of age was taken into one of our hospitals in almost a moribund state from a massive intraperitoneal hemorrhage, incident to a large perforation of the fundus of the uterus from a decidoma malignum. The surgeon was compelled because of the critical state of the patient to perform a rapid supravaginal hysterectomy. Her convalescence was slow and she left the hospital in a very precarious condition, and was again readmitted six weeks later almost ensanguinated from a massive vaginal hemorrhage. On examination, a large fixed mass was found in the left side of the pelvis and a deep irregular crater occupied the site of the cervix. A hasty cauterization was done to save her life. Notwithstanding the hopeless outlook, two aplications of 100 milligrams of radium were made at a six weeks' interval. After the first radiation the bleeding ceased and her recovery was nothing less than astounding. This patient has passed her five-year period and is now well and actively engaged in her household duties and has adopted a child. A very brilliant argument could be constructed in favor of radium were we to let this case occupy the centre of the limelight, but surgery has just as remarkable instances of unexpected cures when the issue appeared as hopeless and we must, therefore, turn to a summary of all cases in order to find a judicial equilibrium. In these startling cases, however, we feel that there may be further pointers towards still better results. Possibly through the use of radium or its emanations carried into the depths of a growth a further advance may be made. At least these remarkable cases furnish a further sustaining argument in favor of the cure of cancer so long as the process is still localized and without metastasis when it is attacked either by surgical means or radium.

Other cases in our series are equally noteworthy, but it is not our purpose to lay great stress upon these highly gratifying isolated instances, but to base our discussion upon the influence of radium in those patients who are not healed. Time will soon establish the question of final cures. In the meantime we feel that a very important advance has been made in the palliative treatment of even the hopeless cases. Thus, in our large series, hemorrhage has been stopped for a considerable period in a very large percentage, in many never returning, in others reappearing at variable periods before the death of the patient. In others it has been notably lessened and but seldom not influenced. No argument is required to sustain this beneficent palliation in these fear-stricken women, for to those who witness this relief the results are self-evident. The malodorous discharges are likewise blotted out in a considerable proportion of cases. In its palliative influence on pain we cannot claim so much, and yet it frequently acts most happily in this direction. In radium cases, as in surgery, however, we must meet the same lay criticism as well as professional pessimism in those instances in which pain is not relieved after radiation or comes on later in the course of the inoperable case. Frequently, this acute terminal agony is charged up to

the account of radiation by relatives or friends of the patient and occasionally this same objection to the use of this novel remedy is sustained by the family physician. Every surgeon knows that surgery is likewise condemned under the same conditions. In all propaganda work, therefore, among laymen as well as within our professional circle, the fact should be dwelt upon that while cancer in its earlier stages is always painless, in its terminal stages it is nearly always agonizing. In only this way may these false assumptions be overcome concerning any remedy which fails.

In the occasional case in our series in which the pain has been especially severe, we have felt that possibly there might be a decided suspicion in favor of this hypothesis and yet within a few days another case may be seen with identical symptoms in which no treatment whatever has been applied. Even admitting this possibility in the occasional case, the many others which have found relief from pain easily overbalance these objections.

Finally, are there any untoward sequelæ chargeable to the radium account? Two are possible. First, does radiation produce pain shortly after the first or second sitting? Occasionally it does. In anticipation of this possibility, we warn the patient not to be alarmed should it occur, for in a small percentage of cases notwithstanding every care exercised in the protection of the rectum a very acute proctitis may follow. In such cases a decided stranguary may be noted at variable intervals from a few days to three or more weeks after radiation. Mucus and even blood may be discharged and the pain may be so severe as to require hypnotics. In some cases opium suppositories may be necessary to quiet the patient. In others a mucilaginous suspension of bismuth subnitrate by rectal injection may be quite sufficient to soothe the pain. In general, however, this symptom is the exception rather than the rule, and will be noted with increasing infrequency as precaution is observed in the protection of the rectum and bladder. Much less frequently is vesical tenesmus noted and, as a rule, it is of a more evanescent type.

As to fistula we have noted 17—9 rectovaginal and 8 vesical. By no means should all of these fistulæ be charged to radium, for in over 200 cases of inoperable cancer which are not treated, certainly this terminal event will occur in a large number of patients. We are convinced, therefore, that such distressing phases of cancer of the cervix are actually prevented, for in the large number of cases which were locally healed of deep ulcerating cervical craters, there has been no further trouble in this locality, and in most of the patients who ultimately died the end came through metastasis or deep pelvic extension.

Briefly stated, therefore, we see in the use of radium in inoperable cases of cancer a greater tendency to relieve pain than to produce it, and also a smaller percentage of fistulæ after its use than in the patients going to their death untreated, or in which various palliative operations are

performed or the actual cautery is applied. Through the results achieved by radiation in this group of inoperable cases, the question is forced into the foreground—Shall we abandon the radical operation in all cases in favor of radiation? As yet, we may not wisely answer this question. Certainly the questionable operative case must be transferred to radium therapy. In the definitely operable case with a well circumscribed area and no broad ligament extension, we still advise hysterectomy. We base this adherence to operation upon the certainty of a definite percentage of cures obtained through surgical intervention. On the other hand, the transfer of every questionable case to the group for radiation is based upon the certainty of a large surgical mortality in the event of an operation, the frequency of disabling sequelæ and the distressingly high percentage of recurrence after even the most radical operation.

Thus far we know that radium greatly supplements surgery and within the next five years it may possibly supplant the radical operation in even the early cases.

Finally, as to the question of operation after radium has apparently reduced the inoperable to an operable stage. Upon this issue we see no reason in favor of this plan. We feel convinced that surgery can accomplish nothing further in such cases. To the contrary, we believe that surgical intervention is most hazardous. The connective tissue contractures in the vaginal vault and parametrium incident to radiation must render the dangers of injury to the bladder, ureters, and rectum greater, and the disruption of connective tissue which may actually have encapsulated the carcinoma may lead to a reimplantation of malignant cells, which may have been held in leash or actually have been rendered innocuous. On the other hand, in the actually operable cases we commend and now follow the plan advocated by Howard Taylor. He radiates all operable cases a few days before hysterectomy is performed. This appears most logical for the operation quickly follows before the actual destructive changes have taken place, and in his experience he finds no increase in the difficulty of a panhysterectomy. This, however, is a very different proposition from that offered after a deep crater has apparently been healed and upon its site dense hyalinized connective tissue has formed which drags the base of the bladder, ureters, and rectum into close juxtaposition.

From our summary of 209 cases we find no cause for discouragement, for we have seen splendid palliative results from radiation, and we think it possible that with a further development of technic, cancer of the cervix may be removed from the surgical domain. Should this transfer become feasible, we are sure we shall find few dissenters among surgeons, for certainly we have no grounds for optimism from a radical operation in the pathetically small percentage of operable cases. For every case which may with reason be submitted to operation at least ten will fall by the wayside because they apply for help too late. To these wretched sufferers radium offers a palliative boon and even a possibility of cure. In cancer of the fundus

the results are too satisfactory to be abandoned in favor of radium, although in at least four cases we have witnessed a very favorable outcome in patients in whom there were grave contraindications to surgical measure. In two instances a cure appears to have been effected. For patients, therefore, suffering with complications prohibiting an operation, radiation offers a decided hope, for in no anatomic situation may we so certainly secure the full force of the radium without ill results. The force of the emanations are chiefly confined to the fundal cavity and the muscular uterine walls shield other organs from injury.

Two years ago we presented a summary of results in 100 cases of inoperable cancer of the cervix and female genital organs treated in the Gynæcological Department of the University Hospital, and arrived at the following conclusions:

"1. As a palliative remedy radium is the treatment par excellence in inoperable cases of cancer of the cervix.

"2. In border-line cases in which formerly we accepted the grave risks of an operation in the hope of eradicating the disease, we now employ radium, but in the certainly operable class we still advocate a radical operation followed by post-operative radiation.

"3. In cancer of the fundus, even when far advanced, we perform a hysterectomy, resorting to radiotherapy only in the face of grave operative contraindications."

In view of our further experience, we now feel that our fourth conclusion, as then set forth, may be modified by a limited claim for actual curability. It was as follows:

"As yet we claim no cures, but, based upon the observation of a considerable number of inoperable cases which have remained locally healed from one to three years, we venture the hope that the quinquennial test will find several survivors."

Results of Radio-therapy in 209 Cases of Cancer of the Female Genito-urinary Organs, Treated in the Gynæcological Department of the University Hospital during the Years 1914–1918

1914		
Living (4 years 4 months)		1
Dead		8
2 months	1	
5 months	1	
6 months	1	
12 months	1	
21 months	1	
2 years	2	
3 years	1	
1915		
Living		4
3 years 3 months	1	
3 years 10 months	1	

3 years 6 months (urethra)	1	
4 years (chorio-epithelioma)	1	
No report		1
Dead		19
3 months	2	
5 months	1	
6 months	1	
4 months	1	
12 months	3	
10 months	2	
13 months	1	
20 months	1	
4 years	1	
4 years 2 months (died from T. B.—no recurrence)	1	
2 months (labia)	1	
19 months (vagina)	1	
19 months (urethra)	1	
2 years 4 months (vulva—died from endothelioma of lung—no local recurrence)	1	
Carcinoma of fundus—died from heart disease few months after application	1	

1916

Living		11
2 years 5 months	2	
2 years 9 months	2	
2 years 10 months	1	
3 years	1	
3 years 1 month	2	
3 years 3 months	2	
3 years 6 months	1	
Well for 22 months and then not traced		1
Well for 5 months and then not traced		1
Well for 2 years and 4 months and then not traced		1
Well for 1 year 2 months and then not traced		1
Well for 2 years 5 months and then not traced		1
Well for 2 years and then not traced		1
Well for 2½ years and then not traced		1
Well for 3 years and then not traced		1
Dead		46
1 month	1	
3 months	4	
4 months	2	
5 months	3	
6 months	4	
7 months	1	
8 months	3	
9 months	1	
10 months	1	
12 months	5	
13 months	3	
14 months	4	

18 months	2	
20 months	1	
21 months	2	
19 months	2	
2 years	2	
2 years 2 months	1	
2 years 3 months	2	
1 year 8 months (fundus—death from cerebral embolus)	1	
6 months (vulva)	1	

1917

Living		23
3 months	1	
4 months	1	
5 months	1	
6 months	1	
11 months	1	
12 months	2	
14 months	1	
15 months	1	
17 months	2	
21 months	1	
2 years	1	
2 years 4 months	1	
9 months (fundus)	1	
16 months (fundus)	1	
17 months (fundus)	1	
18 months (fundus)	1	
11 months (vagina)	1	
16 months (vagina)	1	
21 months (vagina)	1	
Not stated	2	
Dead		33
4 months	5	
5 months	3	
6 months	2	
7 months	2	
8 months	1	
9 months	3	
10 months	1	
11 months	1	
12 months	2	
13 months	4	
14 months	1	
17 months	1	
26 months	1	
5 months (vagina)	1	
11 months (fundus)	1	
11 months (urethra)	1	
12 months (fundus)	1	
14 months (vagina)	1	
Not stated	1	

1918

Living		34
1 month	1	
2 months	6	
3 months	1	
4 months	2	
5 months	2	
7 months	2	
8 months	5	
9 months	1	
10 months	1	
11 months	1	
12 months	2	
14 months	2	
3 months (fundus)	2	
11 months (fundus)	2	
12 months (fundus)	1	
4 months (vagina—following hysterectomy)	1	
12 months (vagina—following hysterectomy)	1	
14 months (vagina—following hysterectomy)	1	
12 months (chorio-epithelioma	1	
No report	13	
Dead		5
2 months	1	
5 months	1	
9 months	1	
10 months	1	
11 months (fundus)	1	
Hemorrhage		209
Stopped	132	
Lessened	26	
Uninfluenced	13	
Not stated	38	
Leucorrhœa		209
Stopped	85	
Lessened	26	
Uninfluenced	28	
Increased	14	
Not stated	56	
Pain		209
Relief	49	
Unrelieved	34	
Lessened	8	
Pain not present at time of first radiation	118	
Fistulæ		17
Vesico-vaginal	8	
Recto-vaginal	9	

THE CHLORINE ANTISEPTICS*

By Walter Estell Lee, M.D.
of Philadelphia, Pa.

The use and abuse of many agents as antiseptics in the treatment of war wounds has been productive of an enormous literature. The pre-war methods of choice and use of antiseptics were entirely empirical, and when these same agents and methods were applied to the massive infections of gunshot wounds chaos resulted. It was not until the problem was approached in a scientific way by Wright, Dakin, Carrel and Dehelley, with adequate analysis of the chemical, physiological, biological and pathological factors involved, that any knowledge of the subject was obtained (Dakin and Dunham, "Handbook of Antiseptics," MacMillan and Co., New York).

That the human tissues have a very definite vital resistance to bacterial infection has been conclusively demonstrated in the recent surgery of gunshot wounds. The standard of surgical sterility established by Carrel as the result of his work with war wounds, one organism in three microscopic fields (1/12-inch oil immersion lens) represents from sixty to eighty organisms to one cubic millimetre of the exudate. A far cry from a condition of bacterial sterility. It is because of this vital resistance of the tissues that it has been possible to practice, in the war wounds, primary and delayed primary suture without the use of antiseptics. As a result of this experience surgeons in the future will have more faith in, and depend to a greater extent upon, the vital resistance of the patient's tissues than they have dared to do in the past.

This vital resistance of the tissues is, however, a variable quantity, being modified by constitutional disease, fatigue, shock, hemorrhage, starvation, and the necessary degree is not always obtainable. The elimination or adequate control of the factors of infection—the focus, the devitalized tissues, and the interval of time between the injury and the receipt of surgical treatment—is only possible in a certain proportion of cases. The mechanical closure of the wound and subsequent rest of the injured part cannot always be provided. For these reasons, at least, surgeons in the future will still require a certain amount of help from antiseptics in a definite proportion of infected traumatic wounds of civil life.

The new work upon antiseptics may be said to be based upon the following principles:

1. The laws governing chemical disinfection, which have been worked

*Read before the Philadelphia Academy of Surgery, March 1, 1920.

out by Chick (*Journal Hygiene*, p. 92, 1908–10, page 238, 1910), show that in all essential particulars the act of disinfection can be regarded as obeying the laws governing the simple chemical reaction, the disinfectant representing one reagent and the bacteria the other. This conception is of the greatest importance, since the cardinal points of disinfection are thereby experimentally established, namely, *adequate active mass* or concentration of the antiseptic, the *necessary time* of action, and *perfect contact* between the reagents.

2. That the germicidal activity of all agents depends to an extraordinary degree upon the media in which they act, almost invariably showing the maximum in distilled water or salt solution. This was demonstrated very early by the workers at Compeigne who showed the fallacy of drawing conclusions from experiments and estimating the values of germicidal agents, unless the artificial medium employed was chemically similar to that of the human tissues.

The work of Dakin, Carrel and Dehelley with the chlorine group of antiseptics is now too well known to need but a reference, and has been fully confirmed experimentally and clinically by the military surgeons of the French, English, and American armies.

That chlorine could be presented to the human tissues without the destructive effect which has prohibited its use in the past, has been one of the surprising developments of the surgery of the war. The use of Dakin's dilute Labarraque's solution containing not more than 0.5 per cent. of hypochlorite was not followed by untoward effects in the infected war wounds as long as they contained devitalized tissue or profuse exudates, but it too frequently exhibited the inherent irritating effects of chlorine upon the skin surrounding these wounds. Recently Dunham ("Handbook of Antiseptics," MacMillan and Co., New York), experimenting with the web of a frog's foot, found that Dakin's solution of hypochlorite affected the tissues in an inverse proportion to their blood supply. Thus, when the solution was applied to the web, the superficial horny and relatively vascular layers were quickly destroyed, then more slowly the subcuticular tissue, but as the hypochlorite approached the blood-vessels its destructive action slackened and finally became arrested before the vessels were reached. There always remained a distinct unaffected zone about the blood-vessels. His explanation was that the protein of the blood plasma transuding through the vessel walls formed a chemical union with the active chlorine, and the resulting chloramine compounds acted as a neutralizing barrier to any destructive action of the hypochlorite solution upon the blood-vessels.

Hartwell and Butler made a clinical report of their work at Bellevue which not only corroborates this experimental work of Dunham, but exhibits a practical application. While no action of the hypochlorite solution was noticed upon living muscle tissue, with its rich blood supply, the relatively avascular tendon and cartilage were rapidly dissolved unless protected by active suppuration and exudation. In their work the use of the hypochlorite solutions was discontinued in these avascular tissues.

The experiments of Gray (Johns Hopkins Hospital Bulletin, October, 1918) and the clinical class-room demonstrations during the war at the Rockefeller War Demonstration Hospital, showed the same phenomena in the tissues of the mesentery when Dakin's hypochlorite solution was injected into the normal peritoneal cavity of a cat. Our clinical experience during the last three years has been just as convincing that the hypochlorite solutions can be used with impunity in peritoneal cavities in which there are abnormal exudates, as in appendiceal and pelvic abscesses.

It is the presence in these peritoneal exudates of the necessary mass of chemical protein and its union with the active chlorine given off by the Dakin's solution that results in the formation of a chemical barrier which protects the normal peritoneal tissues from the destructive solvent action of the hypochlorite solutions. *Thus the danger to the human tissues from the use of Dakin's hypochlorite solution and all chlorine compounds depends upon the relative masses of active chlorine and on chemically available protein.*

Yet this peculiar solvent or proteolytic action of the hypochlorite solutions is now generally realized to have been its greatest asset in the treatment of war wounds. The small masses of devitalized tissue of the traumatic wounds of civil life can practically always be eliminated by the natural autolytic processes of the tissues and rarely is the *vital resistance* embarrassed, at least to such an extent as to endanger life as was the case with war wounds. The war wounds provided masses of dead tissue which were ideal culture material for rapid and virulent bacterial growth and the *vital resistance* was usually overwhelmed. The prompt and efficient removal of these dead tissues by the solvent action of the hypochlorite solutions, and in the latter years of the war by thorough mechanical excision, made the relative values of the mass of infection and the vital resistance of the tissues more like those of civil wounds.

The chemical reactions which occur when chlorine is presented to the tissues, as in the hypochlorite solutions, are almost infinite. However, Dakin and Dunham ("Handbook of Antiseptics," MacMillan and Co.) feel that the proteolytic action of these solutions is not due primarily to any action of the chlorine, but to the various salts which are secondarily formed. Thus, when NaOCl gives off its chlorine a hydrogen element unites with the NaO to form NaOH, sodium hydroxide. This hydroxide is one of the many inorganic salts formed, and it is this type of salts which act as the solvent agents and not chlorine.

The chlorine, as it splits off from the sodium compound, among numerous other reactions, unites with the protein to form amino-radical (NH_3) to form more stable compounds which are known as chloramines. As all bacteria are composed of protein, the chlorine reacting with bacterial protein exerts a *direct germicidal action*. These chloramines, though more

stable than the hypochlorites, holding their chlorine while in the tissues from three to twenty-two hours instead of from seven to ten minutes as do the hypochlorites, also break down and liberate chlorine, and this chlorine unites with other proteins. In just so far as the reaction of the chlorine be with bacterial proteins the chloramine exerts a *direct germicidal action* as did the original hypochlorite. This splitting off of the chlorine from the chloramines results each time in the formation of more and more stable chloramine compounds until a point is reached—after many hours—when the chlorine is so strongly bound to the amines that its germicidal possibilities cease. The practical bearing of all this upon the clinical use of the chlorine antiseptics, *sodium hypochlorite, chloramine-T,* and *dichloramine-T* may be stated as follows:

1. The *direct germicidal effect* of all the chlorine antiseptics is dependent upon the liberation of their chlorine and the combination of this chlorine with bacterial protein.

2. The rapidity with which the *hypochlorite solutions* liberate their chlorine necessitates, in order to avoid the destruction of living tissues, the presence of large masses of available protein (devitalized tissues and profuse wound exudate) or the use of such dilute solutions that a safe margin in the relative masses of the active chlorine and available protein is insured. Thus the usable strengths of hypochlorite solutions, which should be less than 0.5 per cent., liberate such a small mass of chlorine that their *direct germicidal effect* is almost negligible. But, unlike the other chlorine antiseptics, they exert a very definite *indirect germicidal effect* by the formation of hydroxides which act as solvents of the culture material provided by devitalized tissues and wound exudate.

3. The *synthetic chloramines* are more stable compounds of chlorine than the hypochlorites and therefore can be used in greater concentrations or larger germicidal masses. They act practically as reservoirs from which chlorine is slowly and automatically given off as the tissues present the necessary reacting substances (bacterial or tissue protein). Dunham (*Surgery, Gynecology, and Obstetrics,* February, 1918, p. 152).

4. The *hypochlorite solutions* are indicated where there are large masses of dead and devitalized tissues or profuse tissue exudate which cannot be removed by mechanical means. They should not be used where such as are not present or applied to tissues poorly supplied with blood, tendons or cartilage.

5. The *chloramines* are indicated where there is but little, if any, dead tissue, and where the wound exudate is moderate in amount. Their only value is as a germicide. When in the human tissues, they slowly liberate their chlorine over a period of from three to twenty-four hours and in sufficient quantities to automatically unite with the bacterial and other proteins presented by the wounds.

STATED MEETING, HELD APRIL 5, 1920

The President, Dr. George G. Ross, in the Chair

TOTAL CYSTECTOMY—CONDITION OF PATIENT FIVE YEARS AFTER OPERATION

Dr. B. A. Thomas presented a man, forty-six years of age, who was exhibited before the Academy four years ago. The case has been one of particular interest in view of his present state of health, and the nature of the apparatus necessary for deviation of his urinary stream. To the best of the reporter's knowledge this is the only case that has survived, for any length of time, the operation suggested by Watson, of Boston, in 1906; namely, separate nephrostomies, followed by total cystectomy as a third operative procedure.

The patient is employed at present as a mechanic in the Pennsylvania Industrial Home for the Blind. He is able to care for his apparatus routinely. His drainage apparatus is shown in the adjoining cuts (Figs. 1 and 2). It at present consists of two catheters, held in position in the fistulæ with the aid of safety pins and adhesive plaster, and connected by metallic joints to rubber tubing leading to two rubber bag urinals. In this connection it is worthy of note that perhaps no drainage apparatus, in such cases, will be permanently satisfactory. In this case, in the beginning, Watson's apparatus was used, but was soon found to be too bulky and heavy and was strenuously objected to by the patient. Subsequently, one of the urine receptacles of Watson's apparatus was placed over the hypogastric region, suspended by an abdominal belt, to which rubber tubing led from silver-flanged tubes placed in the urinary fistulæ. These at first were bulbous on the inside and fenestrated, but owing to phosphatic incrustations, necessitating their cleansing from time to time, and the difficulty of removal, had to have their bulbous expansions cut off, the tubes then being held in position by adhesive plaster, placed over the external flanges.

This patient had his first cystotomy in January, 1912, for nodular formations at the apex of his trigonum. A few months later these nodular formations recurred, and he was treated in another hospital by fulguration, with little or no improvement in symptomatology. In October, 1913, the patient was admitted to the Polyclinic Hospital and with Young's cystoscopic rongeur two or three of the small intravesical tumors, which at that time completely filled the lower half and neck of the bladder,

varying in size from a small pea to a cherry, were removed and submitted to Dr. John A. Kolmer for histopathological examination, who reported them to be inflamed polypi. The bladder was opened and the interior thoroughly cauterized with the electro-cautery, care being taken to destroy all evidence of these multiple polypoid growths. A few weeks later cystoscopy showed recurrence of the growths, and in January, 1914, the left ureter was ligated close to the renal pelvis and nephrostomy under ether anæsthesia performed. Five weeks later the right kidney was treated similarly, under stovain spinal anæsthesia, and on November 6, 1914, total cystectomy under ether anæsthesia was done, together with religation of the left ureter, because the lumen of the ureter had become reëstablished. This ligation was done with silk; the first having been done with catgut.

Three months later the patient complained of pains in his prostatic region and perineum, of a severe character, and on the presumption that the polypi were reforming in the prostatic urethra, where a few had been previously observed, on March 23, 1915, a perineal extracapsular prostatectomy and total posterior urethrectomy were performed under ether anæsthesia, from which the patient convalesced remarkably satisfactorily. In spite of this strenuous surgical treatment, he is still living and in remarkable health.

INTRAPERITONEAL HERNIA OF THE ILEUM THROUGH A RENT IN THE MESENTERY

Dr. Henry P. Brown, Jr., in presenting the patient, said that from a fairly thorough review of the literature of the past twenty-five years it seems that hernia through a rent in the mesentery, while not being rare, is unusual. He had found reference to nineteen cases, to which he wished to add one that was admitted to Doctor Hodge's service at the Presbyterian Hospital, and upon which he allowed the reporter to operate.

The patient, a white boy of five years, was admitted to the hospital June 23, 1916. Chief complaint was pain in the abdomen and vomiting. While playing on June 21st he fell down two steps, striking on the dorsolumbar region. He was apparently uninjured and resumed play. That night he complained of abdominal pain and vomited a few times. He was given a dose of magnesium citrate which he vomited. On the 24th the vomiting and pain became more severe, and on the 25th a physician was called who diagnosed acute appendicitis and advised operation. His bowels moved the morning he fell, but not since. Although not complaining of much pain, the patient had the pinched features and fixed stare of a very sick boy. The abdomen was distended and very rigid. Peristalsis freely heard over upper abdomen. Tympanitic to percussion. Patient points to painful spot just below umbilicus, but no mass can be palpated. His leucocytes were 21,000 on admission; temperature, 101° F.; pulse, 140; respiration, 46.

Operation June 25th, third day after onset of condition. Ether anæs-

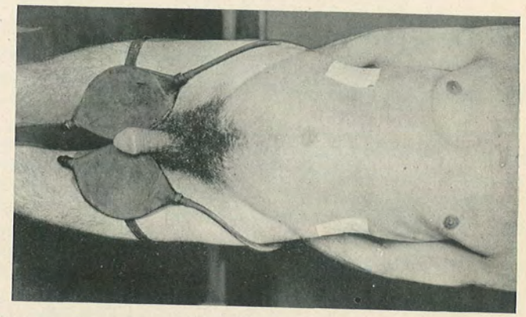


Fig. 1.

Drainage apparatus after total cystectomy.

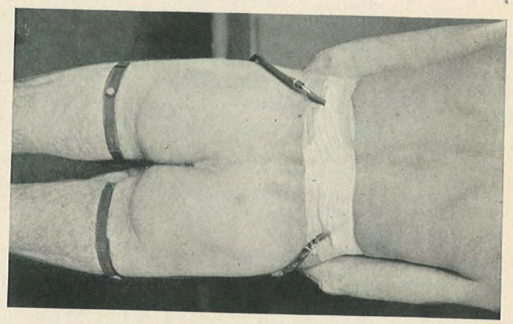


Fig. 2.

thesia. Incision through outer border of right rectus muscle below umbilicus. On opening the peritoneum about one-half a litre of blood-tinged fluid escaped from the abdomen. A knuckle of twisted gangrenous gut, about 20–30 cm. long, presented in the incision, a coil of lower ileum which had passed through a 3-cm. opening in the mesentery, and had become twisted upon itself two and one-half times. The neck of the volvulus was cord-like in character. The opening in the mesentery, located about 5 cm. above the cæcum, had rough edges, apparently of recent origin. The gangrenous loop of ileum was resected and an end-to-end anastomosis was made with a Murphy button. The hole in the mesentery was closed, and the abdomen closed in layers. Hypodermoclysis was given. The patient died four hours after the operation.

A brief summary of the reported cases as collected from the literature is as follows:

CASE I (Reported by C. G. Franklin).—Man seventy-three years of age. Admitted to the hospital with symptoms of intestinal obstruction. Five days before admission, while in bed, he was seized with sudden abdominal pain and vomiting. Slight action of the bowels. Vomiting daily, it becoming feculent in character two days before admission.

Operation day of admission: Coil of small intestine 6 inches long, tightly strangulated in circular aperture in mesentery. Opening enlarged, bowel reduced. It was deep red, port wine in color and deeply indented by the ring. Recovery.

CASE II (Reported by J. G. Smith).—Boy of twelve years. Three weeks before admission had an attack of pain in right abdomen, accompanied by vomiting. Improved. Three days later another attack. Operation: Loops of strangulated intestine, very dark, through hole in mesentery. Easily reduced. Bloody fluid and serum in abdomen. Recovery.

CASE III (Reported by J. S. R. Smith).—Girl of fifteen years. Seized with sudden abdominal pain soon followed by vomiting. Symptoms of intestinal obstruction followed and lasted till operation on the fourth day.

Operation: Bowel greatly congested, small loop of bowel in a hole in the mesentery 2½ by 2 inches. Bowel judged capable of recovery—reduced. Hole had smooth thick margins—congenital in type. No history of previous injury. Recovery.

CASE IV (Reported by J. Clark).—Girl nine years old. Four years previously she had been run over by a trap. Went to bed feeling all right. Had sudden attack of abdominal pain and vomiting. When first seen fourteen hours after onset of attack, she was in a state of collapse. Complete intestinal obstruction. Death twenty-four hours after onset of attack. No operation.

Autopsy: Thirty ounces of bloody serum in the abdomen. Four feet of lower ileum had passed through an aperture in the mesentery, strangulated. Evidence of old peritonitis in this area of the abdomen.

CASE V (Reported by A. P. C. Ashhurst.—Boy of twelve fell and hurt his hip. Next day, dietetic error. Pains in abdomen, vomiting. Symptoms of intestinal obstruction for three days. Abdomen distended, vomiting fæces, blood and mucus by bowel. Umbilicus suggested presence of Meckel's diverticulum.

Operation: Fecal smelling blood fluid—black coil of gut in pelvis resembled volvulus. Resected 14-18 inches of intestine—end-to-end anastomosis—glass tube in pelvis. Death three hours later. Hole in mesentery—ileum passed through till stopped by base of Meckel's diverticulum. Loop of gut was twisted and gangrenous.

CASE VI (Reported by J. B. Deaver).—Sudden severe pain while cranking car—relieved in several days. Six months later while again cranking car had sudden severe

abdominal pain which did not subside. Admitted to hospital in dying condition. No operation. Post-operative examination: Strangulated gangrenous coil of intestine through a congenital hole in the mesentery.

Case VII (Reported by W. A. Lane).—Boy of ten had sudden violent pain in central part of lower abdomen—vomiting. Thoroughly purged by family physician—two days later collapsed.. Complete obstruction of bowels—no previous history of injury or discomfort. Attack came on while asleep. In dying condition when admitted to hospital.

Operation: Second day after onset. Mass of dark bluish intestine 3½ feet long passed through ⅞-inch hole in mesentery. Lower end was 2 feet above ileocæcal valve. Opening was rough. Foul smelling bloody fluid in the abdomen. Patient died on the table.

Case VIII (Reported by L. J. Mitchell).—Boy of eight fell down-stairs, landing on abdomen—apparently unhurt. Two days later complained of severe pain in abdomen. Diagnosed peritonitis by outside physician. No operation. Died four days later. Post-mortem examination: Opening in mesentery near ileocæcal junction, smooth margins. Several loops of strangulated bowel, dark cherry red in color, had passed through it.

Case IX (Reported by A. B. Atherton).—Boy of fourteen years. Subject to attacks of abdominal cramps since six years of age. Present attack started with dietetic indiscretion—was well purged with calomel. Seen two days after onset of symptoms, which were those of obstruction. Died three days later.

Operation: Removed a twisted Meckel's diverticulum, which relieved the obstruction. Died three days later. Post-operative examination: Loop of ileum 1 foot long through hole in mesentery, 6 inches from ileocæcal valve. It was not gangrenous and was easily reduced.

Case X (Reported by Mauclaire).—Woman twenty-one years. Signs of complete intestinal obstruction for five days. Mass palpated between umbilicus and pubes.

Operation: Strangulation of 30–40 cm. of intestine through hole size of palm of hand in mesentery. Margin of opening denoted that it was of long standing. She fell some days before the appearance of symptoms. Death ten hours after the operation.

Case XI (Reported by E .C. Staab).—Woman of thirty-eight. Always suffered with constipation. No history of abdominal injury. Eleven days before admission she had severe abdominal pain which lasted five days, and ceased. Complete obstruction since first attack of pain. In state of collapse when admitted to hospital. Abdomen distended, not tense, no pain.

Operation: Large intestine collapsed from cæcum to sigmoid. On exposing small bowel, a portion slipped out of a hole in the mesentery. Circular hole in mesentery, ⅝-inch in diameter, 3 inches from cæcum. Blood supply to intestine was good. Died from collapse eight hours after operation. Post-mortem—nothing further was found.

Case XII (Reported by F. W. Speidel).—Man shot by companion while out hunting, part of charge entering thigh and arm. While on way to hunt had sudden attack of cramps, and had a bowel movement. At the instant shot was fired, he threw up his hands and pitched forward on the ground. He had severe abdominal cramps which became more severe while on his way home.

Examination showed no evidence of wound to the abdomen. Pain one inch below and to right of umbilicus—vomiting bile. Was given morphine freely, in three hours he having received ten ½-grain doses by mouth and five ⅛-grain doses by hypo. "In short time he was given a dose of opium and in fifteen minutes he was quiet." Next day he was worse—obtained 2 ounces of urine per catheter. No vomiting. Bowels did not move since the accident. Calomel, oil and enemas failed to move him.

Operated on the eleventh day after onset of symptoms. Found a loop of intestine imprisoned in a hole in the mesentery—reduced. Patient died seven days later,

eighteen days after the onset, his bowels not having moved in that time. Fecal vomiting from tenth day to end.

Case XIII (Reported by N. Macphatter).—Woman seventy-three years. No history of trauma. Complained of not feeling well—inability to move the bowels. On the fourth day she showed symptoms of acute intestinal obstruction.

Operation: Loop of intestine through mesentery—twisted—not gangrenous. Enlarged the hole in mesentery—reduced the bowel—closed the hole. Recovery.

Case XIV (Reported by G. K. Dickinson).—Man forty-five years. Symptoms of acute obstruction.

Operation: General peritonitis. Hole in mesentery in region of cæcum—smooth margins—2 inches in diameter. A 2-inch coil of small intestine through the hole held in place by tip of gangrenous appendix.

Author does not mention duration of condition, condition of bowel, what was done, whether there was history of trauma or result.

Case XV (Reported by W. D. Hamaker).—Woman seventy-two years. Obstinate constipation for many years. Sudden onset of symptoms of intestinal obstruction.

Operation third day after onset of acute symptoms: Meckel's diverticulum rolled up in one edge of gangrenous omentum. Rent in upper part of mesentery, through which passed all of transverse colon and omentum. Condition evidently of long standing. Opening was size of an egg. Removed Meckel's diverticulum and gangrenous omentum—reduced hernia. Recovery.

Case XVI (Reported by C. H. Frazier).—Man thirty years. No history of trauma or dietetic indiscretion. Symptoms of acute obstruction.

Operated upon third day after onset. Exposed 18 inches of dilated congested small intestine, protruding through a slit in the mesentery. Easily reduced. Slit probably of long standing. He had an attack somewhat similar to the present one, thirteen years ago—vomiting, pain, constipation and cramps frequently since this first attack. Recovery.

Case XVII (Reported by J. B. Roberts).—Man nineteen years. No stool for five days. Pain—distended abdomen Somewhat similar attack one year previous. Symptoms of acute obstruction.

Operation: In ileocæcal region, small intestine entangled in an opening in the mesentry—easily reduced—no gangrene. "There was apparently no actual protrusion of a loop through the mesenteric opening, but the bent intestine was seemingly thrust into the orifice in such a way that the sharp bend closed the lumen." Orifice seemed congenital. Recovery.

Case XVIII (Glovanoff).—Incarceration of intestines in aperture of mesentery in closure of vitello-intestinal duct. Recovery.

Case XIX (Herczel).—Intestinal incarceration with double volvulus in mesenteric opening. Operation. Recovery

Of these 20 cases, 3 that showed strangulation recovered. Seven with strangulation died. Two without strangulation died. Six that were not strangulated recovered. In one, the condition of the bowel and the result are not mentioned.

In no case was the condition diagnosed before operation. One condition of bowel not mentioned (gang?) died.

REFERENCES

[1] Franklin, C. G.: Lancet, London, 1894, i, p. 334.
[2] Smith, J. G.: Brit. M. J., 1897, i, p. 1022.
[3] Smith, J. S. R.: Lancet, London, 1897, ii, p. 1111.
[4] Clarke, J.: Brit. M. J., London, 1905, i, 594.

[9] Ashhurst, A. P. C.: Annals Surg., Phila., 1910, i, p. 34.
[6] Deaver, J. B.: Surg. Gyn. Obst., 1920, vol. xxx, No. 1, p. 30.
[7] Lane, W. A.: Brit. M. J., London, 1890, i, p. 890.
[8] Mitchell, L. J.: Annals Surg., Phila., 1899, xxx, p. 505.
[9] Atherton, A. B.: Brit. M. J., 1897, 2, p. 975.
[10] Mauclaire: Bull. et Mem. Soc. Anat. de Par., 1899, lxxiv, 247.
[11] Staab, E. C.: St. Thomas Hospt. Reports, London, xxi, p. 172.
[12] Speidel, F. W.: Louisville Med. Monthly, 1895-96, ii, p. 479.
[13] Macphatter, N.: Am. J. of Surg., 1904-05, xviii, p. 232.
[14] Dickinson, G. K.: J. A. M. A., 1907, xlviii, No. 15, p. 1267.
[15] Hamaker, W. D.: J. A. M. A., 1914, lxii, p. 204.
[16] Frazier, C. H.: Phila. Med. Jour., 1899, iii, p. 174.
[17] Roberts, J. B.: Therapeut. Gazette, Philadelphia, December, 1915, p. 1964.
[18] Glovanoff: Voyenno Med. J., St. Petersburg, 1901, lxxix, med. spec., p. 1964.
[19] Herczel: Orvosi betil, Budapest, 1897, xli, 42.

LARGE STONE IN THE BLADDER REMOVED BY SUPRAPUBIC CYSTOTOMY

Dr. George Erety Shoemaker presented a calculus and reported the case of a man, aged sixty-nine years, whose history was as follows: A rectal abscess was incised by his physician some four years ago, since which there has been occasional discharge of pus, and soreness in the perineum. Bladder symptoms have been confused by the patient with the rectal disorder, but for two years there has been increasing difficulty in urination with pain in both groins referred to rectum, down the thighs to the perineum and glans. The patient sits down cautiously, sidewise. Urination every one or two hours with much straining; it is accomplished only in the standing position with both knees bent and the right hip lowered. This peculiarity of position evidently gives a mechanical advantage over the obstruction.

X-ray and metallic sound demonstrated a large stone very low down and fixed. Only two ounces of fluid could be introduced, owing to the violent straining developed, and because of the valve-like action of the stone only a portion of the fluid introduced could be withdrawn by either a soft or hard catheter. There was a moderate amount of acidosis present; the heart was slightly irregular; there was some cough. The blood urea nitrogen was 14 and 7/10 mg. per 100 c.c. The phenosulphonephthalein test was 5 per cent. first hour, 8 per cent. second hour; total, 13 per cent. in two hours. The urine showed but little blood. The organisms present were staphylococcus and streptococcus of low virulence.

Because the bladder was contracted upon the stone which extended above the accessible point of drainage, it was felt that preliminary drainage would be unsatisfactory as a means of preparation for the strain of operation. The preliminary treatment was therefore confined to irrigation, somewhat imperfect, and a milk diet.

Conditions having improved, the p. s. p. test being now 30 per cent. in two hours, suprapubic extraction was done under gas ether. The peritoneum was successfully reflected without injury, assisted by

the introduction of a finger within the bladder. The surface of the stone was rough and friable, some scales adhering to the pocket behind the prostate where the stone was firmly adherent. The scales were carefully picked off and the wound closed down to a drainage tube. A daily irrigation was followed by one ounce of mercuro-chrome 220 one-per cent. solution which was left in the bladder. The drainage tube was out the fifth day. The bladder sinus was closed and normal function fully established the twenty-fourth day. The patient was discharged entirely comfortable, rising not more than once at night and holding the urine from five to six hours. A letter received a few days ago states that he is free from pain or distress; that the urine is clear and free from sediment, and that he rises once in the night. There is no leakage.

Of possible interest in connection with the origin of this stone is the fact that the patient was engaged in business in the far interior of the Honan Province of China some years ago, a region in which stone in the bladder is common. The weight of the stone was 313½ grams when removed. It has been sawed asunder and apparently contains no nucleus. It is composed of calcium oxalates and phosphates.

It may be mentioned that the use of mercuro-chrome appeared to contribute to the comfort of the patient and the freedom from infection during a smooth convalescence.

Dr. Alexander Randall presented a calculus which he thought was probably the largest human vesical calculus removed in modern times. The specimen belongs to Dr. Elmer E. Keiser. The patient was a foreman carder in a woollen mill, sixty-one years of age, slightly built, of medium height, and the father of ten children, the youngest of which is but four years old. Twelve years ago he passed by the urethra several small stones, since which time he has complained of frequency of urination, constipation, hemorrhoids, and has noticed hæmaturia on a few occasions. He likewise complained of a large hernia and great difficulty in properly retaining it. He consulted Doctor Keiser on July 17, 1919, having worked up to the first of that month. His complaint was severe constipation and difficulty with his hernia. On examination a hard tumor was found occupying the lower abdomen and extending from the symphysis pubis almost to the umbilicus. A hard catheter on introduction to the bladder grated on a surface that was believed to be a calculus, and withdrew one and a half ounces of clear urine that gave no evidence of blood, albumin, or sugar. An X-ray showed a remarkable shadow that was believed to be an osteoma of the pelvis. Operation was delayed in the hope of building up the patient's condition, but with no improvement operation was decided upon as a life-saving measure, and was performed on August 11, 1919, by Dr. Wm. H. Morrison at the Holmesburg Hospital, Philadelphia. The peritoneal cavity was not opened, the bladder wall was found markedly thickened, the stone firmly fixed in the pelvis. The patient died thirty-six hours after operation. The calculus

weighed on removal and in its moist state exactly 64 ounces, or four pounds: in its largest circumference it measures 48 cm. and in its lesser 40 cm., the deep impression with the ebonized surface is the imprint of the symphysis, while on the back can be seen the outline of the sacrum and the course of the rectum. The largest human vesical calculus removed as recorded by Gould and Pyle in "Anomalies and Curiosities" is that of Buffen found in 1739, and weighing over six pounds. In modern surgical literature the largest is that reported by Janeway in the *N. Y. Med. Jour.* in 1877 that weighed 51 ounces. Emerson C. Smith in *Surg., Gyn. and Obst.*, November, 1919, reports the successful removal of a stone weighing 38.5 ounces, probably the largest one removed without death. Sir Henry Thompson's "Catalogue of Collection of Calculi," published in 1893, reports numerous specimens of varying size up to 51 ounces. This stone now presented in its dry state weights to-day 56 ounces, and as far as we have been able to discover, is the largest specimen of authentic record.

THE VARICOCELE OPERATION

Dr. Penn G. Skillern read a paper with the above title, for which see page 108.

GUNSHOT INJURIES TO THE CHEST

Dr. George J. Heuer (by invitation) presented a paper, illustrated by lantern slides, with the above title, for which see page 111.

Dr. John H. Gibbon said that in probably no field of surgery, excepting joints, has there been greater advance than in the treatment of gunshot wounds of the chest. Of the very distinct lessons that surgeons can draw from their own war experience and that of others in regard to gunshot wounds, the most striking thing in the presentation of Doctor Heuer's communication is the results obtained in those patients not operated upon, and they constituted a large majority of the whole series. Another notable thing was the comparatively small percentage of cases of those not operated upon which required operation later and in this lies one of the lessons that we must apply in civil practice. There are very few simple penetrating wounds of the chest in view of this experience that would require immediate operation. One of the most difficult things one had to do was to get away from the habit of operating on these cases and to prevent others from operating upon them. Although we laid down the rule very often, he saw many cases of penetrating wound operated upon that had none of the indications for operation given by Doctor Heuer. To operate and drain means infection and always will. As to the remarks of Doctor Heuer as to what happens to cases in which the skin was not sutured, in a British base hospital in 1917, the speaker saw many cases of joint, abdominal and chest wounds that had been apparently properly treated which healed promptly and in which late infection took place under the skin, and required opening up afterwards; in the chest and joints infection of

the underlying cavities occurred. The abdominal cavity was not infected because the adherent omentum protected it. Therefore he concluded it would be a good plan to leave the skin open in these cases and later did so in a number of cases at a British casualty clearing station. He is now convinced that was a mistake. Doctor Heuer shows the cases did badly when the skin was closed. In regard to anæsthesia, he thought that all these infective cases, cases that were not operated upon at once and became infected later, should be operated on under local anæsthesia. Practically all the cases Doctor Heuer reports were drained under local anæsthesia. It is similar to operations in empyema which should be always done with local anæsthesia. One of the types of cases most instructive was combined abdominal and thoracic injury. Doctor Heuer reports a number of cases operated upon, although the abdomen was penetrated, in which there was no perforation of the abdominal viscera. They had a number of these cases in his evacuation hospital in which the abdomen had been penetrated and yet in which no operation was done and in which the patient got well. They established the rule there that if we were fairly certain that a hollow viscus had not been perforated and the chest wound did not require operation, no operation should be done. These cases were a great deal better left alone. Hemorrhage of the liver from gunshot wounds takes better care of itself than the surgeon can. When he starts in to stop it he usually makes it worse. These cases require the exercise of the best surgical judgment to determine those which should be operated upon and those which should not.

Dr. George J. Heuer in answer to the question regarding the expectant treatment of certain combined chest and abdominal injuries, said that in a series of thirty-nine combined chest and abdominal injuries, six cases were treated expectantly. In five of the cases the foreign body was embedded in the liver. Four of the six cases recovered; two died, one of gas gangrene of the leg, the other of lobar pneumonia of the lung opposite to that injured. Regarding the occurrence of hemorrhage and bronchial fistula during the process of sterilization of infected hæmothorax or empyema in fifteen cases of infected hæmothorax under his care abroad, neither hemorrhage nor bronchial fistula occurred following the use of Dakin solution irrigations. In the empyemata of civil life he recalled four cases in which hemorrhage had followed the irrigations. It has been rather interesting to note that hemorrhage in these cases has occurred late, at a time when sterilization of the cavity has almost been accomplished. Bronchial fistula has developed in the course of the irrigations in two cases.

A CONSIDERATION OF THE VARICOCELE OPERATION AND THE AVOIDANCE OF POST-OPERATIVE INDURATION*

By Penn G. Skillern, Jr., M.D.
of Philadelphia, Pa.

An undesirable sequel of operation for the cure of varicocele is the column of induration that frequently forms and that extends from the testicle upward through the scroto-abdominal passageway to the external inguinal ring. This column of induration may persist for several weeks, and to this extent the cure may be said to be worse than the disease. So disabling was this column of induration considered in recruits that in the first period of the World War official bulletins advised not to operate upon varicoceles unless they were of very large size and productive of symptoms. The writer had occasion to perform the varicocele operation in perhaps several dozen cases during the past three years, and the following observations are based upon the study of this series of cases.

The causes of this column of induration seem to be: (1) Limited resection of veins with end-to-end suture of stumps: this results in stagnation of blood in closed vessels, with a lump at the site of the stumps; (2) failure to obliterate the dead spaces established by dissection of the fascial layers: these dead spaces furnish room for the outpouring of blood and tissue juices after operation; (3) irritation of the vas deferens from rough manipulation: I have found the vas very sensitive to trauma, to which it reacts by swelling to several times its original size.

Many operations have been devised for the cure of varicocele, but to the writer it seems that there need be but one operation—an operation that will remove the disease and yet not be followed by the above undesirable sequelæ. No operation removes the disease which does not remove the entire mass of veins involved. No operation is satisfactory which does not obliterate dead spaces left remaining by mere edge-to-edge apposition of the divided fascial layers, or perhaps no suturing of these layers at all. No operation is satisfactory which brings about irritative reaction of the vas to trauma from rough manipulation.

The writer obtains satisfactory results as regards the above details by performing the operation as follows:

An incision is made over the inguinal canal as for herniorrhaphy, dividing skin, Camper's fascia, Scarpa's fascia, and the aponeurosis of the external oblique muscle, opening into the external ring. The cremaster muscle with its fascia is next divided and retracted, exposing the spermatic cord enclosed in the thin infundibuliform fascia. The part of

* Read before the Philadelphia Academy of Surgery, April 5, 1920.

the spermatic cord first seen is the anterior group of veins which are varicose, and which constitute the bulk of the varicocele. This anterior group of veins is picked up at the internal ring and freed from the infundibuliform fascia as far as the testicle below. During this manœuvre the anterior veins are drawn away from the posterior veins and vas, so that there is no occasion to disturb the vas in any manner whatsoever, nor even to touch it. By keeping away from the vas there will be no misgivings as to the integrity of the circulation of blood to the testicle *via* the deferential artery and veins, nor any as to the post-operative irritational swelling of the vas. While freeing the veins close to the testicle the tunica vaginalis may be opened inadvertently: such an opening, however, is not undesirable, for it prevents post-operative acute hydrocele formation in a closed sack. The opening, when made, should not be closed: it will heal of itself within a few days.

The anterior tortuous veins having been freed are ready for ligation. Removal of the entire pathology requires that these ligatures be applied at the testicle below and at the internal ring above. The thickest part of the varicocele is at the testicle, and the thinnest is at the internal ring, where usually but two veins are present to return the blood from the varicocele to the spermatic vein. In certain cases the varicocele extends into the inguinal canal, where it forms a bulge simulating hernia. The advantages of opening the canal are that such a varicocele extending into the canal may be dealt with, and also that isolation of the veins may be begun where the veins do not contact with the vas, *i.e.*, at the internal ring. The ligatures are applied as follows.

Using No. 1 plain gut carried by an aneurism needle the vein mass is transfixed close to the testicle and the suture is tied on both sides of the mass. A clamp is applied to the vein mass proximal to the ligature in order to prevent soiling of the field with blood escaping from the veins when divided, and the vein mass is divided between the ligature and the clamp. In similar manner the two veins at the internal ring are transfixed and ligated, care being taken not to pinch in the ligature the little pouch of peritoneum which appears anteriorly when the veins are freed close to the internal ring. For safety's sake a second ligature is applied close to the first, for if but one ligature be applied and should slip off, annoying retroperitoneal bleeding from the retracted stump would arise. A clamp is applied to the vein mass distal to the second ligature, and the veins are divided between the clamp and the second ligature. The vein mass between the clamps is now removed from the field: its length varies from four to six inches. The inguinal canal is now occupied by the vas with its vessels and the posterior set of veins, which usually are not varicose. The cremaster muscle with its fascia is now sutured snugly down upon the vas, this being accomplished by passing the sutures at a distance from the cut edges. If it is desired to draw the testicle to a higher position, the cremaster muscle with its fascia is sutured trans-

versely, although I have rarely found this step necessary. I may say in passing that I do not believe in shortening the scrotum by resection, for when an undue weight is removed from the scrotum, the latter contracts soon or late, when the dartos and cremaster muscles recover their physiologic tonus.

The retracted ilio-inguinal nerve is now replaced, and the incision in the external oblique aponeurosis is closed. Scarpa's fascia is closed as a separate layer and tacked down upon the external oblique aponeurosis, thus obliterating the dead space that otherwise would exist between these two layers, and also approximating the cut edges of Camper's fascia and skin. The skin is closed by interrupted sutures of silk-worm gut. After the dressing has been put on a suspensory is applied to the scrotum, and the latter is elevated over the pubes to counteract gravity.

Since employing the above technic I have not seen the column of induration arise. All the palpating fingers find after operation is the ligature stump at the top of the testicle and above this the normal-sized vas pursuing its course up to the inguinal canal. There may be a transitory enlargement of the testicle while the deferential vessels are establishing the compensatory circulation, but atrophy of the testicle is no more frequent than after orchidopexy for ectopia: indeed, it is very rare, and should not be as frequent as in the latter condition.

The patient is allowed out of bed in two days and discharged from hospital on the sixth day, cured of varicocele without undesirable sequelæ.

PENETRATING WAR WOUNDS OF THE CHEST

A CLINICAL STUDY OF ONE HUNDRED AND SIXTY CASES

By George J. Heuer, M.D.
of Baltimore, Md.,
George P. Pratt, M.D.
of Omaha, Neb.,
and
Verne R. Mason, M.D.
of Baltimore, Md.

At the time of America's entrance into the war, surgical opinion among the French, British, Germans, and Italians regarding the treatment of penetrating thoracic wounds had only in a measure crystallized. It had been clearly demonstrated that patients with sucking thoracic wounds did not respond well to expectant treatment, and unless immediately operated upon, died, in the large percentage of cases, either from shock, hemorrhage, and traumatopnœa, or from later infectious complications. But this was perhaps the only point in the surgical treatment of thoracic wounds upon which there was general agreement. It was emphasized by some (Duval and others) that at forward hospitals acute hemorrhage was a factor which contributed toward, or was responsible for, a certain mortality, and constituted a positive operative indication. The necessity for controlling active hemorrhage was admitted, but that it occurred in actual war experience and that it therefore constituted an operative indication, was denied by others (Hartman, *et al.*), who stated that under existing war conditions patients arrived at forward hospitals either moribund, in whom no operation was justifiable, or with hemorrhage spontaneously checked. It was asserted by some (Duval and British observers) that a large foreign body—over 1 cm. in diameter—should be removed at a primary operation in both open sucking wounds and closed wounds; and for the reason (infectious complications) that the removal of foreign bodies was generally admitted to be necessary in the treatment of wounds elsewhere. There was, however, no unanimity upon this point. A number of surgeons (among them Tuffier) were of the opinion that foreign bodies were well tolerated by the lung; that therefore in closed wounds and in open sucking wounds—unless at operation they lay directly at hand—they should be left alone until some complication directly attributable to them demanded their removal. It had been observed that the tangential and other wounds associated with extensive rib fractures, even though the parietal wounds were not open, were prone to develop infectious complications under expectant treatment; and in the opinion of some should therefore be subjected to immediate operation in order to avoid these complications. Upon this point, however, there was no general agreement. These were the larger questions which were still being discussed.

Among the minor questions were those referring to the treatment of small open wounds and the method of approach and closure of thoracic wounds. The question of approach was whether this should be through the wound of entrance or exit or at a point of election. The question of closure of thoracic wounds was whether this should be complete and without drainage; partial, that is, closure of the pleura leaving the parietal wound open; or with drainage of the pleural cavity.

In regard to the less serious injuries there was quite general agreement. The through-and-through bullet wounds, if without open pneumothorax or extensive rib fractures, and the penetrating bullet and small shell wounds of similar character, were generally admitted to do well under expectant treatment and were treated medically. The more important questions still being discussed were the time and method of aspirating hæmothorax and the time and method of treating infected hæmothorax.

Evacuation Hospital No. 1, the first of the forward hospitals to be established in the American Expeditionary Forces, began its activities with a fairly definite routine in the treatment of thoracic injuries;[1] namely, to treat expectantly or medically the through-and-through bullet wounds without open pneumothorax or extensive rib fractures, and the penetrating bullet and small shell wounds of similar character; and to operate immediately or as soon as possible upon (*a*) those with open sucking pneumothorax, at the time of the primary operation removing foreign bodies, controlling hemorrhage, and suturing or resecting the lung when indicated; (*b*) those with an acute continuous hemorrhage threatening life; (*c*) those with large intrapleural or intrapulmonary foreign bodies; and (*d*) those with extensive rib fractures. The question of complete tight closure of the thoracic wound was left for the time being an open one, but primary drainage of the pleural cavity was not contemplated. With the exception of one period, this outline for the treatment of thoracic injuries was consistently carried out. During a period of activity in September, 1918—a period of great stress of work, during which there was an influx of new surgical teams inexperienced in thoracic surgery—we in part failed to carry out this routine, and erred, if of necessity we did so, on the side of conservatism. This circumstance, although unfortunate, we believe, from the standpoint of the patient, enables us to offer a comparison of results which we otherwise could not do.

What have been the results of this more or less consistent line of treatment of thoracic injuries? Is it from the standpoint of immediate results the best immediate treatment of thoracic injuries in the army zone? Should it be modified toward radicalism or conservatism under varying circumstances? Our study may throw some light upon these questions and upon the unsettled points mentioned in our introductory paragraph.

[1] Dr. John Gibbon, of Philadelphia, then surgical consultant to Evacuation Hospital No 1, was responsible for this routine treatment of thoracic injuries; and to his good judgment and his many helpful suggestions are largely due the results obtained in the treatment of thoracic wounds at Evacuation Hospital No 1.

The material which forms the basis of this study includes the following:

(*a*) One hundred and nineteen cases of penetrating thoracic wounds which were entirely under our care at Evacuation Hospital No. 1.

(*b*) Twenty-two cases in which the primary operation was performed by a number of surgeons at Evacuation Hospital No. 1 during September, 1918. These cases were seen and examined on admission by one of us (Heuer) who then acted as *triage* officer. After operation they came under our care, and such secondary operations as were necessary for post-operative complications were performed by us.

(*c*) Twenty-four cases observed at Base Hospital No. 18 at a time when it functioned as an evacuation hospital. These cases were most carefully studied and are of value in comparing the results of treatment instituted early with that instituted late.

It should be emphasized that we have unusually good records of all the cases included in this report; and because of the active coöperation of internists (Pratt and Mason), röntgenologist[2] and surgeon.

For the convenience in discussion we may divide the cases into two groups—(1) those not primarily operated upon, and (2) those subjected to immediate operation.

GROUP I. ONE HUNDRED AND FIFTEEN CASES NOT PRIMARILY OPERATED UPON

A summary of this group may be given as follows: Of the 115 cases there were 53 bullet wounds and 62 shell wounds; 47 were perforating with a wound of entrance and exit; 68 were penetrating with retained missiles either in the chest wall, pleura, lung, or upper abdomen. Six were small (1–2 cm.), open sucking wounds; 109 were closed wounds. Of the perforating wounds, all, with one exception, were due to bullets.

The patients arrived at Evacuation Hospital No. 1 in the majority of instances within twelve hours after their injuries; at Base Hospital No. 18 in from one to seven days after their injuries. In the evacuation hospital series a slight or moderate grade of shock was the rule on admission; but in addition to these moderate grades, profound shock was not uncommon and was observed in twenty-one cases. Eleven of these cases recovered after vigorous shock treatment; 10 cases, practically moribund on admission, died within an hour or two after their arrival. Eighteen cases entered Evacuation Hospital No. 1 with normal pulse and blood-pressure, in whom all signs of shock were absent; and this was practically true of the base hospital series.

It would require too many pages to comment at length upon the physical findings in this group of cases, and we shall therefore but mention some of them. *Cough, hæmoptysis,* and *dyspnœa* were extraordinarily common

[2] We are indeed indebted to Dr. Ira M. Lockwood, of Lincoln, Neb., at the time röntgenologist at Evacuation Hospital No 1, for his coöperation in the study of these cases. His painstaking localization work especially was invaluable to us.

and would appear to occur almost invariably when the pleura and lung are penetrated. *Acute primary hemorrhage* threatening life was not seen in a single instance in this series. In the ten cases moribund on admission, hemorrhage, if that was the chief cause of the serious shock, had spontaneously ceased. As will be noted later, secondary hemorrhage occurred in two cases. *Mediastinal compression symptoms* (dyspnœa, cyanosis, tachycardia) due to a high grade of hæmothorax were noted in twelve cases; but in none were they so urgent as to require immediate aspiration for their relief. *Extensive subcutaneous emphysema* was present in twelve cases, a slight degree in many cases. *Pure hæmothorax* occurred in 94 of the 115 cases, or in 81 per cent. In thirty-eight cases the fluid level reached well above the angle of the scapula (hæmothorax large); in twenty-nine cases reached the angle of the scapula (hæmothorax moderate); in twenty-seven cases did not reach the angle of the scapula (hæmothorax small). *Hæmopneumothorax,* exclusive of seven cases subsequently developing an anaërobic infection with gas formation, was demonstrable in twelve cases. In six cases it occurred in open wounds, in six cases in closed wounds. A *pure pneumothorax* occurred in three cases. *Hemorrhagic consolidation of the lung,* not the common type occurring about the wound tract, but involving the lung at some distance from the wound, was demonstrable at autopsy in four cases; in three it involved the lung on the side of the injury; in one the lung contralateral to the injury. *Collapse of the lung,* that interesting condition emphasized especially by British observers, was seen in only one case, but may well have frequently escaped infection. *Elevation and immobility of the diaphragm* upon the side injured was observed, although its frequency, due to the difficulty of recognizing the exact position of the diaphragm in the presence of hæmothorax, cannot be accurately stated. *Pleural and pericardial friction rubs* occurred in a few cases. *Mild abdominal signs and symptoms* were rather common in the low thoracic injuries; were marked in four cases in which a board-like retracted abdomen with hiccup and vomiting strongly suggested the perforation of a hollow abdominal viscus.

The position and course of the parietal wounds may be seen in the accompanying diagrams (Figs. 1 to 4). The wounds involved almost every part of the thorax; the missiles penetrated in almost every direction. In general the wounds were small punctured wounds without extensive laceration of tissue. Only 6 of the 115 were open wounds and these could be converted into closed wounds by a pressure dressing. Only two wounds of the entire series were obviously infected at the time of admission. The incidence of *associated rib fractures* cannot be accurately stated, for the chipping of a rib so easily escapes detection. Extensive rib fractures, however, were noted in eight cases, fracture of the clavicle in one case, of the sternum in two cases, and of the scapula in five cases. In the vast majority of cases the *foreign bodies* retained within the thorax were small (1 cm. in diameter or less). In eight cases the shell fragments measured over 1 cm., but not over 2 cm. in diameter; in seven instances machine-gun or rifle bullets were retained.

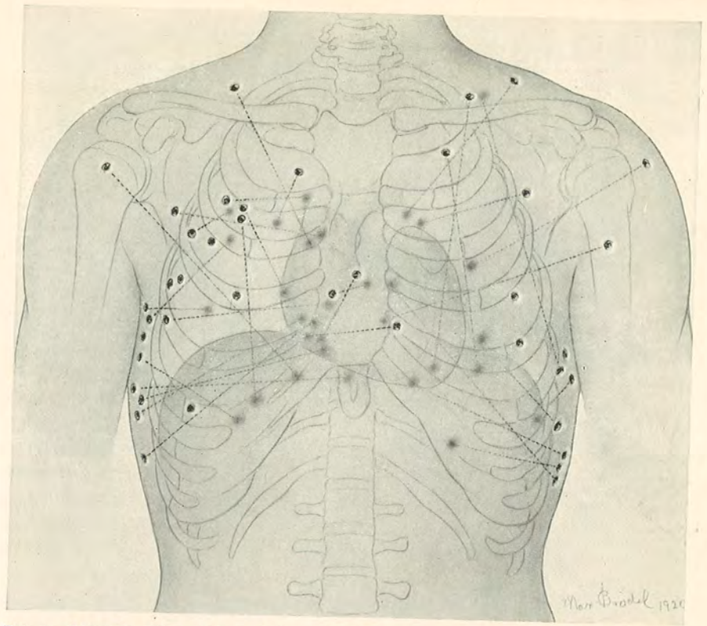


FIG. 1.—Composite picture of forty of the penetrating wounds of the ventral surface of the thorax of which we have accurate records. The wound of entrance is represented by a black dot, the course of the missile by a dotted line, and the point of lodgment of the foreign body by a shaded dot.

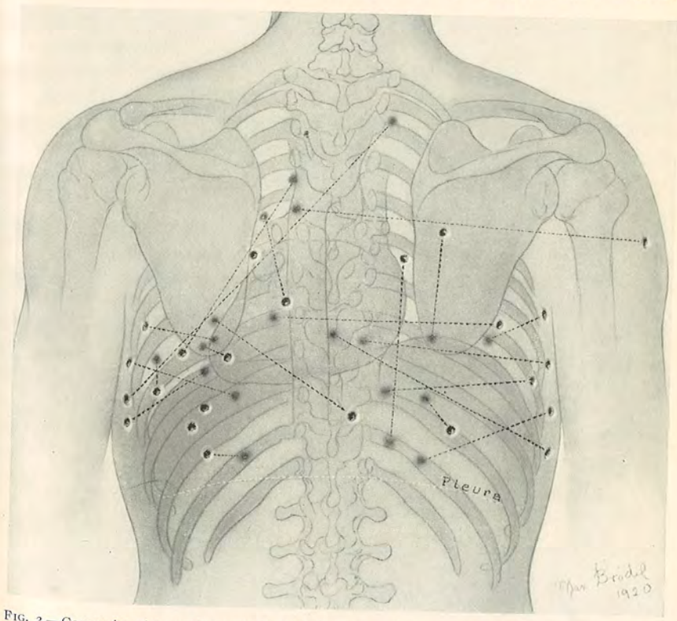


FIG. 2.—Composite picture of twenty-three of the penetrating wounds of the dorsal surface of the thorax. The same technic for representing the wound of entrance, the course of the missile, and the point of lodgment of the foreign body is used as in Fig. 1.

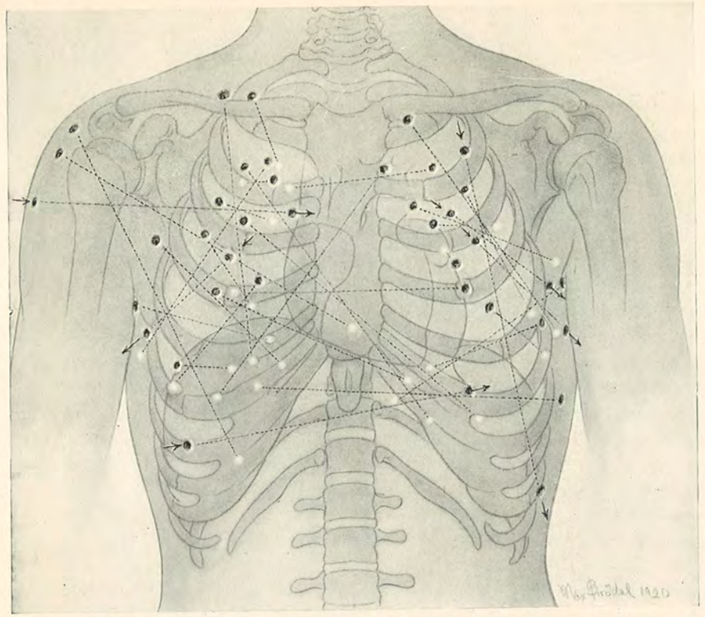


FIG. 3.—Composite picture of thirty-nine of the perforating wounds of the ventral surface of the thorax of which we have accurate records. The wound of entrance is represented by a black dot, the course of the missile by a dotted line, and the wound of exit, if upon the dorsal surface of the thorax, by a white dot. The wounds which perforated the ventral surface of the thorax alone are represented by black dots and arrows.

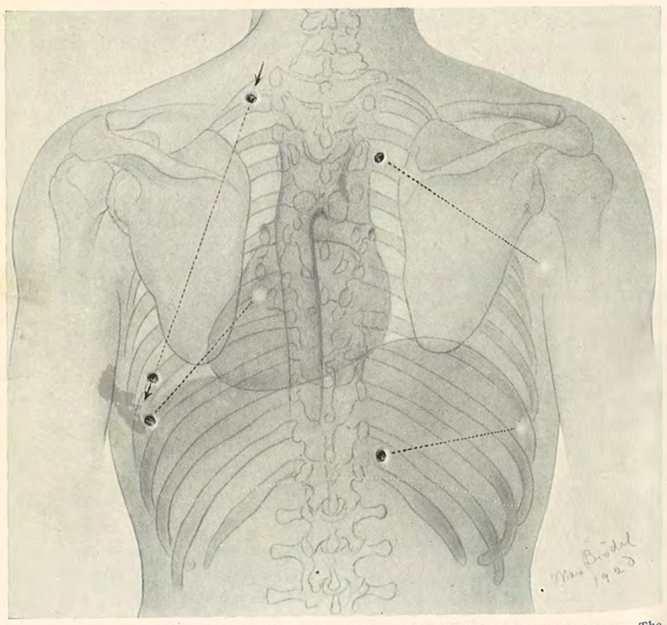


FIG. 4.—Composite picture of the perforating wounds of the dorsal surface of the body. The same technic for representing the wounds of entrance and exit is used as in Fig. 3.

The *clinical course* in these cases was either normal for thoracic wounds or complicated by infection or hemorrhage. Dismissing the ten cases moribund on admission and dying a few hours after their arrival, 80 cases pursued a normal clinical course, 25 developed some complications with reference to their thoracic injuries.

What we may term a normal uncomplicated course may be briefly outlined. The patients, admitted in a condition of shock, often with dyspnœa, cyanosis, and anxiety, and with a varying amount of pain, cough, and bloody expectoration, present the picture of a serious injury. With complete rest in a heated bed and with morphia in adequate doses to induce quiet, the whole picture, as a rule, changes within a few hours, and, with the exception of the very seriously shocked, almost invariably by the following day. Their general appearance improves, their color returns, their pulse becomes stronger, their blood-pressure rises; dyspnœa and cyanosis become less marked; and their anxiety disappears. Cough with bloody sputum varies; it may be slight or it may be troublesome for days. Their striking change for the better is a source of astonishment, and gives rise to the impression that their previous apparently serious condition was out of all proportion to the injury or the amount of blood lost. In the seriously shocked the response to treatment is not so marked, and, as in eleven cases of this series, the condition of shock may give rise to anxiety for from twenty-four hours to three days. Fever in cases progressing normally is the rule and may vary within wide limits. In our series of cases the temperature soon after admission rose to 100° to 101°, sometimes to 103° to 104°, and showed either a continued elevation over several days or daily slight remissions. Most frequently the temperature began to decline on the third to the fifth day, but showed a daily rise to 99° to 100° for from ten days to two weeks. A relatively high fever may, however, persist for two weeks and may not completely disappear for three or four weeks. In a relatively few the temperature may be normal and remain so throughout the course. With the exception of cough, bloody sputum and fever, which are common to these injuries, no untoward symptoms appear; and within two weeks the patient's strength has returned and he is able to be up and about.

Complications.—Unlike that in many institutions in forward areas in which prompt evacuation of patients was imperative, it was our policy not to discharge patients with thoracic injuries until the danger of all complications had passed. We believe, therefore, that the complications to be enumerated represent practically the total incidence of complications in this series.

Infected Hæmothorax.—This, the most frequent complication of penetrating thoracic wounds, occurred in 18, or 17 per cent., of the 105 cases which survived the immediate effects of their injuries. Three of the 15 cases in the base hospital series, or 20 per cent., developed this complication; 15, or 16.5 per cent., of the evacuation hospital series. The predominating infecting organisms were the gas bacillus of Welch in seven cases, the strepto-

coccus hæmolyticus in three cases, the streptococcus viridans in one case, pyogenic staphylococci in five cases, and unknown in two cases. When we critically examine the cases which developed infected hæmothorax, we find that seven cases had neither open wounds, large retained foreign bodies (in two of these cases the size of the foreign body is not known), nor extensive fractures; in other words, did not present the conditions which we had learned predisposed to infectious complications. The remaining eleven cases, however, presented one or more of these conditions. It is interesting to note that four of the six cases with small open wounds developed infected hæmothorax; seven of the eight cases with retained shell fragments larger than 1 cm. in diameter developed this complication; as did three of the eight cases with extensive rib fractures. Eleven of the cases which developed infected hæmothorax were wounded by shell fragments which were lodged within the thorax; seven were wounded by bullets, of which six perforated the thorax and one penetrated and lodged within the thorax. While too small a series from which to draw any positive conclusions, the evidence from it supports the view that open sucking chest wounds, large retained foreign bodies, and extensive fractures of the bony thorax are conditions which favor the development of infectious complications.

The clinical course in cases developing an infected hæmothorax is usually quite different from those progressing normally. We can distinguish two groups of cases: those in which infection develops early and those in which it appears late. In the instances of early infection the temperature, which in cases progressing normally begins to fall on the third to the fifth day, fails to do so; rather it shows each day a little higher elevation or may assume a septic curve. In addition, the patient does not feel well nor look well, as in uninfected cases, but complains of thoracic pain and dyspnœa, has tachycardia, is restless, and has disturbed sleep. Such relatively benign symptoms should give rise to the suspicion of infection and warrant aspiration for cultural purposes. In the single case of streptococcus viridans infection, no more alarming symptoms developed; but the streptococcus hæmolyticus, gas bacillus, and some of the pyogenic infections were accompanied by high fever, tachycardia, signs of toxæmia, and thoracic pain. In the instances of late infection (developing from one to three weeks after the receipt of the wound) a normal course with a falling temperature was rather suddenly followed by a sharp elevation of temperature and by the symptoms and signs we have just enumerated. The physical signs in both groups may remain as before; or show an increase in the fluid level. Most striking in their symptomatology and physical signs are the infections with anaërobic organisms (Welch bacillus), whether occurring early or late. Within twenty-four hours the patient, previously progressing normally, becomes seriously ill, with a temperature of 104°, with a pulse of 120 to 140, and with dyspnœa, cyanosis, toxæmia, and delirium. Physical examination shows a marked change due to the gas formation. A pneumohæmothorax has replaced the hæmothorax, and the intrathoracic pressure has increased, as shown by the cardiac displacement.

Pneumonia.—Pneumonia occurred in two forms—as a septic broncho-pneumonia occurring about the seat of the lesion, or as a lobular or lobar pneumonia. Obviously, it is difficult to form any accurate estimate of the frequency of pneumonia upon the side wounded; for the presence of hæmothorax, of hemorrhagic consolidation, of congestion, and of the symptoms of fever, cough and blood-stained sputum, so common in all chest wounds, makes a proper interpretation of the physical signs almost impossible. By autopsy examination pneumonia was demonstrated in seven cases, four of which were associated with infected hæmothorax. In two cases an extensive broncho-pneumonia of the usual type occurred in the lung contralateral to the injury; in two cases a widespread septic broncho-pneumonia surrounded the pulmonary wound; and in two cases a bilateral septic broncho-pneumonia was present. In only one case did we observe a pneumonia of the lobar type; and in the lung contralateral to the injury. By physical examination four other cases which recovered were considered to have had a broncho-pneumonia on the side of the injury.

Pulmonary abscess and gangrene were exceedingly rare in this series. In one case included under the cases of infected hæmothorax above, pulmonary gangrene with secondary abscess formation was recognized by the fetor of the breath and the offensive expectoration, and was confirmed by autopsy examination. In a second case a lung abscess, unsuspected clinically, was found at autopsy. The patient, with two penetrating thoracic wounds and multiple wounds of the extremities, developed gas gangrene of one leg, necessitating a thigh amputation. He died with all the symptoms of gas intoxication. At autopsy a lung abscess 7 by 5 cm. was found along the wound tract in the middle lobe of the right lung, lying freely in which was a fragment of rib driven into the lung by the missile. The missile itself was embedded in the liver with no reaction about it.

Septicæmia, pyæmia, and *purulent pericarditis* occurred in association with other infectious complications of thoracic wounds in three cases.

Infection of the parietal wound, as previously noted, was observed in but two cases on admission, and in these was of no moment. The single serious infection which occurred in this series was a gas infection (Welch bacillus) which developed in a bullet wound and spread rapidly in the tissues of the thoracic and abdominal walls. In spite of the most radical incisions, the patient promptly died of gas gangrene. At autopsy there was no other cause of death.

Secondary or late intrapleural hemorrhage occurred in two instances. One patient was wounded by a shell fragment posteriorly, the missile traversing the right thorax obliquely and lodging under the skin just to the right of the sternal margin. For six days he pursued a normal uncomplicated course; then suddenly after violent coughing complained of weakness and went into collapse. When seen he was pallid, cold, and sweating, and had a scarcely perceptible pulse at the wrist. The signs of hæmothorax had increased. Although recognizing the hemorrhage, thoracotomy to control it

was out of the question. In spite of our usual measures to combat shock the patient died. At autopsy the right thoracic cavity was completely filled with blood, and the heart markedly dislocated toward the left. An open wound of the right internal mammary artery was found and it was supposed that a clot had been dislodged from the vessel during the paroxysm of coughing. The other patient was wounded in the left supraclavicular space, the foreign body lodging in or upon the left diaphragm. In addition to a high grade of hæmothorax he had abdominal pain, marked abdominal rigidity, and hiccup. Twice in the early days of his injury he vomited blood. On the tenth day after the injury, following an effort to sit up in bed, he suddenly complained of left thoracic pain and almost immediately went into collapse. Pallor, sweating, air hunger, imperceptible pulse, and a mounting hæmothorax, all indicated a secondary hemorrhage. The day of and the day following the accident 2700 c.c. of bloody fluid were aspirated because of pressure symptoms. The cultures from the fluid, previously sterile, showed a hæmolytic streptococcus, and therefore a rib resection with drainage of the infected hæmothorax was done so soon as the patient's condition warranted it. Subsequent sterilization of the cavity by Dakin's solution was followed by secondary closure of the sinus tract.

Treatment.—The treatment in this group of cases may be briefly outlined. Absolute rest in a warm bed and morphia in sufficient doses to induce quiet were the first and important steps in the treatment. Shock was immediately and energetically treated by the usual methods. As previously noted, all our efforts in the treatment of shock were unavailing in the ten cases practically moribund on admission. In the lesser degrees of shock, blood transfusion, intravenous gum acacia (Bayliss's solution), intravenous saline, hypodermoclysis and salt and coffee per rectum, together with elevation or bandaging of the extremities were used. Our success in treating shock depended upon its degree and duration. The profoundly shocked in our experience did not respond to the various methods which we employed, excepting to blood transfusion when hemorrhage was the factor in the production of shock; nor did those who had been seriously shocked for from twelve to twenty-four hours before coming to us. It is indeed difficult in such a small series of cases to form any just estimate of the value of various measures in the treatment of this condition. Through the efforts of our "shock teams" we have accurate records of pulse and blood-pressure determinations before and after the use of various measures; and we may summarize our experience as follows: (*a*) That marked beneficial effects follow the use of external heat, rest, and morphia in the lesser degrees of shock; (*b*) that blood transfusion is of the greatest value in those in whom hemorrhage is the factor in the production of shock. Yet we observed patients profoundly shocked in whom there was no evidence of serious hemorrhage and in whom blood transfusion had but slight, if any, effect upon the pulse or blood-pressure. In these cases Bayliss's solution failed to have any more effect. (*c*) That in profound shock of *long duration* neither

Bayliss's solution nor intravenous saline, hypodermoclysis, nor salt and coffee per rectum had any appreciable effect upon the pulse or blood-pressure. In the few cases which recovered it cannot be said, however, that these measures did not have some beneficial effect. (*d*) That in the lesser degrees of shock intravenous saline or salt and coffee had about as marked an effect upon the pulse and blood-pressure as did gum acacia. Our poor results in the treatment of profound or serious shock we feel were due to the fact that the condition as we saw it at an evacuation hospital was not comparable either to the *recent* shock produced in the laboratory or to that seen in civil life following operations. It had persisted for hours and sometimes for twenty-four hours before treatment could be instituted.

The subsequent treatment of this group of cases consisted in the treatment of mediastinal compression symptoms, of hæmothorax, and of infectious complications. Mediastinal compression symptoms were treated by aspiration. In the majority of the twelve cases requiring this procedure, one aspiration of 500 to 800 c.c. sufficed; in two cases as many as three aspirations on successive days were necessary. The treatment of hæmothorax was along well-established lines. Aspiration was done for two purposes—for diagnosis and for treatment. Knowing that every thoracic wound was potentially infected, and fearing the consequences of unrecognized infected hæmothorax, a small syringeful of blood for cultural purposes was aspirated either daily or every other day in all cases which were not progressing perfectly normally. Aspiration for treatment was performed because the large collections of fluid are absorbed very slowly, and when not removed give rise to a thickened pleura and adhesions obliterating the costodiaphragmatic sulcus; conditions which impair pulmonary function and give rise to many post-traumatic subjective complaints. In the series of 105 cases, aside from the removal of small amounts of blood, aspiration of from 200 c.c. to 3000 c.c. of blood was performed in thirty cases, and chiefly in those with large collections of fluid. Two methods of aspiration were used—an early aspiration of from 200 c.c. to 500 c.c. on the fourth or fifth day, repeated if necessary on succeeding days until all the blood was removed; or a late aspiration, usually on the tenth to the twelfth day, removing at one sitting all the blood that could be obtained. A third method—early total aspiration combined with artificial pneumothorax, used with especial success by Italian observers—was not employed by us. Of the two methods used by us, early aspiration was used in twenty cases, late aspiration in ten cases. To have used aspiration in the treatment of hæmothorax in but 30 per cent. of our cases would appear to indicate that we were not enthusiastic in its use; but this is not true. In the earlier period of our experience, we, as many others previously inexperienced in the treatment of thoracic wounds, failed to aspirate many cases which later would have been subjected to this treatment. In the large and moderate collections of fluid, aspiration is an aid in the treatment of hæmothorax, for it permits a more rapid expansion of the lung, and, when done early,

probably prevents the deposition of a thick layer of fibrin upon the pleural surfaces. We have no evidence, however, that aspiration prevents the obliteration of the costodiaphragmatic angle nor the formation of adhesions between the diaphragm and costal pleura. A study of the X-rays of our cases shows that practically all cases previously having a large or moderate hæmothorax had at the time of their discharge (a month or more after their injury) adhesions obliterating the costodiaphragmatic angle; and to practically the same extent whether aspirated or not. Pleural thickening was a much less conspicuous finding; nor was retraction of the thorax very evident. If we can judge from our own series, obliteration of the costodiaphragmatic angle is the most constant and conspicuous of the abnormalities following hæmothorax.

The treatment of the eighteen cases developing infected hæmothorax consisted, with one exception, in rib resection and drainage so soon as the diagnosis was established by cultures of the aspirated fluid. We cannot see any justification for delaying operation and resorting to aspiration until a frank empyema has developed, for only too often a delay is followed by septicæmia, purulent pericarditis, pyæmia, and death. Operation was followed by sterilization of the pleural cavity by Dakin's solution; with subsequent excision and closure of the sinus so soon as the cavity was sterile. In the single exception to this form of treatment—an instance of streptococcus viridans infection—we resorted to repeated aspiration. The patient eventually recovered, but his convalescence was prolonged beyond that of those treated by rib resection, and we are certain that he would better have been treated as the others.

Of these 18 patients, 11 recovered and 7 died. An examination of the autopsy records of the 7 dead shows that in only one was death due to a simple infected hæmothorax. Four cases showed an extensive bronchopneumonia; one case, pulmonary abscess and gangrene associated with a bronchial fistula; and one case showed a healed sterile cavity, death being due to septicæmia and pyæmia, the result of a purulent knee-joint. In the cases which recovered, the cavities were sterile and closed at the time the patients left the hospital. We know the late results in only two cases, and both of these are of great interest. Due presumably to firm adhesions preventing the expansion of the lung, the cavity persisted in one case for four months, in the other for eight months. Yet during all this time the sinus tracts, closed over the sterile cavities, remained healed and the patients suffered in no way because of the presence of their unobliterated pleural cavities. Subsequently both cavities became obliterated; and since their return to this country we have X-rays of these patients showing the complete obliteration of these long-standing cavities.

The treatment of the other infectious complications requires no further comment.

Results.—Of the 115 cases included in this group 10 were admitted in a moribund condition and died within a few hours after their arrival, untreated excepting for measures to combat shock. In the 105 cases which survived their primary injury, there were 11 deaths, 7 of which occurred in the group of cases which developed infected hæmothorax. Of the 4 other deaths, one followed hemorrhage from the internal mammary artery; one, gas infection of the thoracic wall; one, gas gangrene of the leg; and one, lobar pneumonia. In two cases death was wholly due to causes unrelated to the thoracic wounds. The total mortality in this group was, therefore, 18 per cent. If we exclude the cases moribund on admission and those dying from other injuries, the mortality in the 105 cases is 8.5 per cent. As previously noted, 80 cases pursued an uncomplicated course. These were kept in bed, as a rule, for from ten days to two weeks; were discharged in from three weeks to one month. They were comparatively free from symptoms and apparently well, and we have the feeling that few could have developed later complications. In the 11 of the 18 cases which survived infected hæmothorax, the pleural cavities were sterile and the sinus tracts closed before the patients were discharged.

Discussion.—When we review this series of cases in the light of our study, could we have improved our treatment? The group of 10 cases moribund on admission were clearly beyond our help, and if any treatment could have benefited them, it should have been and perhaps was carried out at the dressing station. With the exception of one case of fatal secondary hemorrhage, all the 11 deaths not occurring immediately from shock and open thorax were the result of infectious complications, and it is to these that we should particularly devote attention. Seven deaths followed infected hæmothorax; one death was due to an uncomplicated pneumonia, 2 to gas infection and gangrene. Granted that the surgeon is skilled in thoracic work, it would seem in the light of subsequent events that we could have done better had we excised and closed the open wounds, removed the large foreign bodies, and repaired the extensive rib fractures, for these conditions were obvious factors in the causation of infected hæmothorax. We should, in other words, have taken these cases from the non-operative group and placed them in the operative group.

GROUP II. FORTY-FIVE CASES SUBJECTED TO IMMEDIATE OPERATION

These cases include: (1) Twenty-two operated upon a group of surgeons at Evacuation Hospital No. 1 during September, 1918; they were seen and examined by one of us (Heuer) who then acted as *triage* officer, and after operation came under our care; (2) 8 cases operated upon at Base Hospital No. 18 at a time when it functioned as an evacuation hospital; and (3) 15 cases operated upon by one of us (Heuer). Ten were bullet wounds and 35 shell wounds; 9 were perforating with a wound of entrance and exit; 36 were penetrating wounds with retained foreign bodies. Thirty-three were

large open "sucking" wounds; 12 were closed wounds.[3] These figures show the preponderance of shell wounds over bullet wounds in these more serious injuries.

Time Interval.—In the evacuation hospital series the time interval between receipt of the injury and admission to the hospital varied between six and twenty-four hours, in the large majority being about twelve hours. In the base hospital series it varied from twenty-four hours to eight days.

Shock.—In the evacuation hospital series a profound degree of shock was the rule in those with open sucking chest wounds. The patients arrived pale, cold, and pulseless, with a low blood-pressure and with dyspnœa, cyanosis, and anxiety. Undoubtedly, open pneumothorax is one of the most important contributing factors in this serious grade of shock, and it was often noted that the patient's condition improved after the thoracic breach was closed. Moreover, it seemed clear that the large open wounds were associated with greater shock than the smaller wounds. In those with closed thoracic wounds, shock was a less conspicuous feature, and in at least five cases the appearance and clinical signs of shock were absent. In the base hospital series shock, with one exception, had been recovered from at the time of the patient's admission.

Cough, hæmoptysis, and *dyspnœa* were more troublesome in those with open sucking wounds than in those with closed wounds. While in the latter, cough can usually be controlled by sedatives, in the former it cannot be satisfactorily checked until the thoracic wound is closed. Dyspnœa, relatively uncommon in our series with closed wounds, was invariable in open wounds, was sometimes most distressing, and was always accompanied by a varying degree of cyanosis. It persists so long as the thorax is open, and indeed tend to become progressively worse.

Acute primary hemorrhage threatening life did not occur in those with closed wounds; was in no instance the indication which led to thoracotomy in those with open wounds. Yet upon opening the thorax in four of the cases the lung was found to be actively bleeding, the continuation of which would undoubtedly have caused a fatal termination.

Character of Wounds.—With the exception of the twelve closed wounds, the character of the wounds in this group of cases was in marked contrast to those in the preceding group. They were large, varying in size from 2 to 5 cm. in diameter, and showed extensive laceration of the skin, subcutaneous tissues and muscles. In practically every case, from one to three ribs were extensively fractured, and in addition there occurred fractures of the scapula, sternum, and spinous processes of the vertebræ. Six of these extensively lacerated wounds with comminuted fractures of the bony thorax were caused by bullets, the remainder by shell fragments.

[3] In the Base Hospital No. 18 series the original condition of the wounds at the time of admission is not positively stated. In the absence of a definite statement it is assumed that they were closed wounds, and are counted as such.

In the open wounds the retained foreign bodies varied in size from 1.5 to 3 cm. in diameter; in the closed wounds they were small.

Hæmothorax in pure form occurred in all but one of the twelve cases with closed wounds. The amount of fluid in those with open wounds varied with the position of the open wound, for the blood escapes from the wound with respiratory movements and coughing.

Abdominal signs were noted in eight cases. These consisted chiefly of upper abdominal tenderness and rigidity. In no case was there hiccup, and in only one case was vomiting noted. At operation the diaphragm was perforated or lacerated in all cases which showed abdominal signs; in one case which showed perforation of the diaphragm no abdominal signs were present.

Clinical Course.—The clinical course in this group of cases cannot be discussed, for all the cases were within a short time after their arrival subjected to operation. Yet we know from our observation of the ten cases included in Group I as moribund, and from the literature of French, British, German, and Italian observers during the early period of the war what the clinical course of these cases is when treated expectantly. In those with large open wounds, shock is not recovered from, but rather becomes more profound and death occurs in the majority of cases in from twenty-four to forty-eight hours. Should life be prolonged for several days, infection invariably occurs and terminates the course. The mortality in the early period of the war was practically 100 per cent. In those with small open wounds life may be prolonged, but infection is almost certain.

Operative Treatment. (*a*) Indications. Before taking up our operative procedures let us for a moment discuss our operative indications. As noted in our introductory paragraph, our routine operative indications were open pneumothorax, large retained foreign bodies, extensive rib fractures, and acute primary hemorrhage threatening life. To these we must add our inability to positively diagnose the presence or absence of an intra-abdominal injury. When we analyze our cases these operative indications occurred as follows:

1. Open sucking thoracic wounds occurred in thirty-three of the forty-five cases (73 + per cent.), and was the urgent operative indication. In twenty-six of these cases we have records of extensive fractures of one to three ribs combined in some instances with fractures of the scapula, sternum, and vertebral spines. In twenty-three of these cases a large foreign body was retained. In the shell wounds of the thorax, therefore, the combination of three of our operative indications presented itself in the large majority of cases (70 per cent.). Open thorax alone without extensive fractures or retained foreign bodies was the indication in two cases, large retained foreign body alone with the operative indication in only one case. Extensive fractures alone was the indication in but two cases, but from our experience in Group I should have been the operative indication in others.

2. Acute hemorrhage threatening life was not the prime indication in any case, but as previously noted, in four of our personal cases active hemorrhage from the lung was found at operation. Active bleeding from the thoracic wall was not observed.

3. Our inability to diagnose the presence or absence of an intra-abdominal injury was the indication for thoracotomy in six cases, but in two there was the additional indication of a large retained foreign body. Had we felt sure of the absence of an abdominal injury, four of these cases might well have been treated expectantly.

Operative Procedures.—Contrary to the outline given in our routine that operation in thoracic injuries should include excision of the wounds, removal of foreign bodies, control of hemorrhage, treatment of the wounded lung when indicated, and subsequent complete closure of the thoracic wound, this complete operation, if we may so term it, was not consistently carried out. Rather, three more or less distinct procedures were carried out, and it will be of interest to compare the results obtained in each.

1. The simplest procedure employed was the excision or *débridement* of the wound of the soft parts and the removal of bone fragments. The thoracic cavity was not opened widely, the hæmothorax not evacuated, the foreign body not removed, and the lung not examined. The pleura or intercostal muscles were closed, and the skin either closed or left open. The procedure, then, consisted simply of *débridement* with closure of open wounds, or *débridement* with opening and reclosure of closed wounds. This type of procedure was employed in seven of the base hospital cases and in one of the evacuation hospital cases—eight cases in all. It is evident from the histories that these were the least seriously injured. Shock had been completely recovered from in the base hospital series and was absent in the single case in the evacuation hospital series. The wounds were small, the rib fractures not so extensive as in the more serious injuries. The results in this group of cases were as follows: Three of the eight patients died; one from presumably a valve pneumothorax, one from pulmonary gangrene, and one from lung abscess. The death from valve pneumothorax was due to faulty technic and should have been avoided. An incomplete closure of the pleura was followed by symptoms of pressure pneumothorax which were recognized too late to save the patient. At autopsy nothing to account for death excepting a pneumothorax was found. Two additional cases which recovered developed post-operative complications. In one the wound, not completely closed at the primary operation, became infected, with the subsequent development of pyopneumothorax; in the other an infected hæmothorax developed requiring a subsequent rib resection and drainage. Fifty per cent. of these cases, therefore, developed post-operative infectious complications following incomplete operations, of which 37.5 per cent. died. It should be remembered, however, that operation in these cases was performed late—at a time when infectious complications are more prone to occur.

2. The second procedure consisted in the *débridement* of the wounds, an exploratory thoracotomy, the evacuation of the blood in the thorax, the *débridement* and suture of wounds in the lung when feasible, and the removal of foreign bodies when possible. The pleura was closed, but the overlying muscles and skin were left open because of the presumed danger of infection. This procedure was carried out in twelve cases. Six patients recovered without complications and were discharged well. Four patients developed infections in the wounds which had been left open, the infection resulting in the reopening of the pleura and the development of a pyopneumothorax. Three of these four cases died, their death being due to infection; one recovered after a secondary rib resection and drainage at a point of election. Two additional cases died within twelve hours of the operation from shock. The mortality in this group was, therefore, 41.6 per cent. Infectious complications occurred in 33.33 per cent. In contradistinction to the first group of cases these were operated upon early; that is, within eighteen hours from the receipt of their injuries. It is interesting to note that none of these cases developed pulmonary abscess or gangrene. How much a complete operation had to do with it is difficult to determine. Bone fragments embedded in the lung, if of any size, were certainly removed. Foreign bodies were removed in three cases; were not removed in five cases. In three perforating wounds foreign bodies were not present.

3. The third procedure consisted in the careful excision or *débridement* of the wound, the careful removal of all bone fragments from the pleura, the evacuation of the hæmothorax, the removal of foreign bodies and bone fragments from the lung whenever possible, the excision of the wounds in the lung when feasible, followed by suture, and the complete air-tight closure of the thoracic wound. This so-called complete operation was carried out in twenty-five cases. Twenty-one patients recovered, all but one without any complications whatever; one case developed a post-operative infected hæmothorax but recovered following a rib resection with drainage. Three cases died of shock within twelve hours of operation; one case died of a post-operative streptococcus empyema. The mortality in this group, therefore, was 16 per cent. Post-operative infectious complications occurred in 8 per cent. In this series foreign bodies were removed in fifteen cases, not removed in three cases, and not stated in three cases. In four cases of perforating wounds no foreign bodies were present.

Discussion.—When we compare the results obtained by these three procedures the most striking dissimilarity is in the frequency of post-operative infectious complications. Following the first procedure, 50 per cent. of the cases developed such complications; following the second, 33.33 per cent.; and following the third, 8 per cent. The condition of the patient may be eliminated as a factor in these results. Shock was absent in the first group, present in equal degree in the second and third groups. The time interval is a definite factor in the results in the first group, for the operations were performed late, when infectious complications are more prone to occur.

Time is not, however, a factor in the results in the second and third groups. The difference in the results appears to be due to the type of operation which was performed. In the first group the operation was totally inadequate. Lacerated wounds of the lung and large collections of blood in the presence of infected missiles and bone fragments—wound conditions which are prone to give rise to infection—were left untreated. In the second group, although a relatively small number of foreign bodies were removed, the obvious great mistake was the failure to completely close the thoracic wound. As a result the parietal wound became infected, the pleura reopened, and a pyopneumothorax developed—conditions which were responsible for all the deaths not due to shock. The third procedure as outlined above, and including the complete air-tight closure of the thoracic wound, gave by far the best results and would appear to be the operation of choice in cases requiring immediate operation. That it is adequate when carefully performed is indicated by the fact that in fifteen cases operated upon by one of us (Heuer) there was not, aside from a single stitch abscess, a single complication of any sort.

Results.—The results in this group of forty-five cases have been in part indicated above. The total mortality in the series was twelve, or 26.6 per cent. Of the thirty-three cases which survived, thirty recovered without complications, and three developed infected hæmothorax which required a secondary rib resection and drainage. In the thirty cases which recovered without complications, the immediate and presumably also the late results, were most satisfactory—much more so than in cases treated expectantly. The lung was completely expanded in ten days, pleural thickening did not occur, and adhesions fixing the diaphragm in a high position were absent. Subjective complaints of thoracic pain, dyspnœa, and tachycardia were quite uniformly absent. The results were so much better than in cases treated expectantly that one is almost tempted to suggest thoracotomy in the treatment of hæmothorax. Of the twelve cases which died, five deaths were due to shock, six to post-operative infectious complications, and one to post-operative pneumothorax.

To sum up the entire series of 160 cases: There were 127 recoveries and 33 deaths, a general mortality of 20 per cent. If we exclude the 10 cases moribund on admission and dying untreated and the 2 deaths due to causes unrelated to their thoracic wounds, the mortality is 13 per cent. Eighty cases in the non-operative group recovered without complications; 25 developed complications, with one exception of an infectious nature. Of these 11 died. Ten patients died of shock, untreated except for measures to combat shock. Thirty cases in the operative group recovered without post-operative complications; 10 developed post-operative infectious complications, of which 7 died. Five cases died of shock within twenty-four hours after operation.

As a result of this study we may offer what evidence we have bearing upon the treatment of penetrating thoracic injuries. Our experience confirms what had already been established, that a large open thoracic wound constitutes a positive operative indication, and tends to show that the small open wound as well should be immediately closed. That the large retained foreign body is an operative indication is not so evident from our study, but it is quite apparent that it is prone to give rise to infectious complications and should, therefore, in our opinion, be removed. In the absence of all other operative indications, however, should we deliberately perform a thoracotomy in order to remove a large foreign body from the lung? Only rarely in our experience (one case in our series) will this question arise, for, as we have shown, the large foreign body is most frequently associated with open wounds and fractures of the bony thorax. In the absence of all other indications, however, the large foreign body in our experience should or should not be an operative indication, depending upon the experience and skill of the surgeon in thoracic surgery. Our experience shows that extensive rib fractures also are prone to give rise to infectious complications, and sufficiently often to warrant operation. As an isolated condition, however, extensive rib fractures are uncommon, and occur most frequently in conjunction with open wounds or large foreign bodies. Acute continued hemorrhage was never in our experience, either in the non-operative group or in the operative group, an isolated operative indication, yet in four cases operated upon because of other indications, active hemorrhage was found. Our experience, therefore, is similar to Hartmann's that in practice acute continued hemorrhage is rarely an indication, yet its possibility must always be remembered.

As a good working basis in the treatment of penetrating chest wounds we feel that the operative indications we have discussed should stand, but realizing that while stated as single indications, they rarely occur alone. When operation is indicated our experience shows that as complete an operation as the wound conditions demand, with removal of the foreign body and complete closure of the thoracic wound, is the operation of choice.

Should we be content with the medical, or non-operative, treatment of those penetrating wounds which do not present the above indications? If we exclude from our 105 cases the relatively few with small open wounds, with large retained missiles and with extensive rib fractures, but 7 of the entire series developed infectious complications and but 5 died. When it is remembered that these results were obtained in the army zone, where the mortality from thoracic wounds is highest, we must at the present time be satisfied with this method of treatment. From the standpoint of functional end-results it leaves much to be desired, for, as we have found and as the literature indicates, retraction of the chest, thickened pleura, adherent diaphragm, and subjective complaints are common sequelæ. It is clear that operative measures prevent these sequelæ and might prevent some of the infectious complications, yet it seems certain that an added mortality due to indiscriminate operative measures would more than counterbalance the benefits derived.

From a survey of the entire literature on war wounds of the thorax, and from a study of our cases, we feel warranted in saying that the treatment which has been outlined is the best immediate treatment of thoracic injuries which has thus far been suggested. Should it be modified toward radicalism or conservatism under varying circumstances? We have no evidence to show that even under the best conditions more radical treatment would yield better results. On the other hand, our own series of cases shows the bad results of conservatism; that is, of treating expectantly those with open chest wounds, large retained foreign bodies, and extensive rib fractures. We felt compelled during one period, because of stress of work and the inexperience of surgeons in thoracic work, to include the less seriously wounded, showing these conditions among the non-operative group; with the result that our percentage of infectious complications and our mortality were greatly increased.

STATED MEETING, HELD MAY 10, 1920

The President, Dr. George G. Ross, in the Chair

DISLOCATION OF THE SHOULDER AND FRACTURE OF THE SURGICAL NECK OF THE SCAPULA, CAUSED BY MUSCULAR ACTION DUE TO ELECTRIC SHOCK

Dr. George M. Laws exhibited a man of twenty-eight years, with no history of previous fracture except fractured ribs from adequate trauma, who, in the early days of his experience as an X-ray operator four and a half weeks ago, received a shock in this manner. His hands were outstretched so that they were a few inches from the wires and happened to be cold and wet. The current entered his left hand, passed across his body and out his right hand, holding both of them in contact with the wires. The left upper extremity was fully extended, forward and horizontal, and in order to break the circuit he pulled it downward and backward with all his strength. Suspecting a dislocation of the shoulder from his symptoms he made a film which confirmed it, and then went to his physician who reduced it, whereupon he went back and made another film. A few days later the physician brought him to me to clear up some doubtful features of the case. He then presented the signs of a minor injury at the acromio-clavicular joint and a fracture of the surgical neck of the scapula which was better shown by subsequent radiograms. Union is not yet firm and tenderness persists at the suprascapular notch and at the site of fracture on the axillary border. Incidentally he received a burn on each hand.

Dr. T. Turner Thomas said that he had never recognized a case of fracture of the surgical neck of the scapula. The X-rays in this case are a little bit vague, but show clearly damage done to the glenoid process. He had seen in a number of cases operated on for recurrent dislocation of the shoulder more or less of the anterior part of the glenoid process broken off. He recalled one case where the glenoid process was broken in half; the anterior part being entirely separated from the scapula and the posterior part being continuous with the scapula.

PYOCOLPOS AND PYOMETRA IN A CHILD AGED SIXTEEN MONTHS

Dr. Damon B. Pfeiffer reported the case of a female child aged sixteen months who was admitted on February 4, 1920, to the service of Dr. J. P. Crozer Griffith in the Hospital of the University of Pennsylvania.

The chief complaints were retention of urine and fever. The patient was one of twin girls normally born. Both were bottle-fed, and had been pale and rather delicate, but had had no serious illnesses. This child had always been constipated. The father, mother, and two older sisters were living and well. The child was in her usual health until about ten days before admission, when she became fretful and feverish. The mother noticed that she strained as if in pain and passed no urine. The family physician was called and he removed ten ounces of urine by catheter. Since that time she has required catheterization four times daily. On questioning, however, the mother stated that the child had been "always wet" before the onset of the present illness. On admission the temperature was 103° F., pulse 128, and respirations 28 per minute. The temperature remained high with moderate variations throughout the course of the illness.

The child weighed 19 pounds and was rather fat, but presented an unhealthy, yellowish pallor. She was feverish, fretful, and uneasy. The head, neck, and chest were negative except for slight evidences of rickets. The abdomen was tense and much distended. Above the umbilicus the abdomen was tympanitic. Below the umbilicus there was dulness over an oval area corresponding to the position which would be occupied by an enormously distended bladder. Here a firm, somewhat resilient mass could be felt rising from beneath the symphysis. It was smooth except at the summit, where a definite nodule was palpable. There was no evidence of free fluid within the abdomen. There was tenderness in the right loin posteriorly. Catheterization obtained 12 ounces of urine of specific gravity 1006, acid in reaction, showing a trace of albumin and much pus, otherwise negative. After catheterization the mass previously felt was slightly smaller but otherwise unchanged in character. Rectal examination revealed a mass filling the cul-de-sac anteriorly which was similar in character and evidently continuous with the suprapubic mass. The vaginal outlet was normal in appearance. It seemed to have a lumen, did not bulge, and no attempt was made to examine vaginally. It was the consensus of opinion that the mass was a tumor, probably of embryonic sarcomatous character and inoperable. On the day after admission the blood examination was as follows: Hæmoglobin, 21 per cent.; red blood-cells, 2,930,000; white blood-cells, 23,800; polynuclears, 80 per cent.; lymphocytes, 16 per cent.; mononuclears, 2 per cent.; transitionals, 2 per cent.

The course was down grade. On the ninth marked venous stasis appeared in the left leg. Radiographic examination was inconclusive but suggested to Doctor Pancoast that the mass was cystic. On the following day, thinking that it might be possible to drain a suppurative cystic collection with a minimum of time and trauma, for it was apparent that the child was almost moribund, under light ether anæsthesia the abdomen was opened over the mass, which was at once perceived to be cystic. On the summit the uterus and adnexa were perched, normal in appearance

except for distention of the uterus to about 4 cm. in length and 3 cm. in width at the fundus. Recognizing the condition as cystic dilatation of the vagina and uterus, the wound was covered and the vagina dilated. Just within the vestibule was an imperforate septum which was punctured with immediate discharge of about a litre of watery, yellowish pus. Unfortunately, at this stage the child ceased to breathe and died in spite of attempts at resuscitation.

An immediate post-mortem examination showed marked bilateral pyonephrosis and pyoureter. The anatomical conditions and relations suggested that the cavity of the vagina had become infected by direct extension from the lower end of the infected ureters, though it can not be denied that the pyocolpos may have preceded the urinary infection which would then have been favored by pressure and stasis.

RETAINED DRAINAGE TUBE FOLLOWING CHOLECYSTOTOMY

Dr. Morris Booth Miller reported the following case as worthy of note as an unusual accidental sequel of cholecystotomy. Incidentally it furnishes an additional though rare argument in favor of cholecystectomy in gall-bladder disease. It further carries a lesson to the hospital interne who was probably responsible for the mishap which required reoperation eight years later.

T. F., aged fifty years, a native of Poland, was admitted to the Medico-Chirurgical Hospital on March 18, 1920, with chief complaint of pain in the right epigastrium. As he could only speak Polish a history was obtained through an interpreter and this at its best was inexplicit and unsatisfactory. As nearly as could be learned he had been troubled with pain in the epigastrium since the age of thirteen. He was operated on in Troy, N. Y., eight years ago for this pain and was somewhat improved but not entirely relieved. As to the after-treatment he states that "a large tube was in his side and that when this came out a smaller one was put in." He seemed totally ignorant of the cause which led to the second operation, and naturally and for obvious reasons, he has not been enlightened. Two years ago he commenced to have pains in the upper abdomen resembling sticking of pins; sometimes the pains radiated to the back or right side; no vomiting at any time, but has had occasional periods of nausea; no noticeable loss of weight; has been generally constipated. No history of colic.

Physical examination revealed practically no phenomena of importance. Heart and lungs were normal, no enlargement of spleen or liver. There was a scar over the right rectus commencing at the costal margin running straight downwards for about 10 centimetres. Abdomen soft with no distention, and the only unusual feature which was noticed was slight rigidity over a small area about the upper portion of the scar. Even this was apparently voluntary and thought to be associated with the place where he felt the pain. He breathed freely without increase of pain.

There was no jaundice. The urine reports showed nothing suggestive and gastric analysis gave no material departure from the normal. Blood examination showed a small increase in leucocytes to 8700, dropping in two days to 6500, but otherwise negative. As he was entirely afebrile he was kept under observation as a probable mild case of cholecystitis, possibly due to stone formation. Further investigation, however, with the aid of the X-ray, revealed the cause beyond a question of doubt, as the shadow of a piece of drainage tube was distinctly shown lying transversely below the liver.

Incision through the right rectus revealed many adhesions between the parietes, stomach, duodenum, and liver. Patient dissection exposed the fundus of the gall-bladder lying well under the liver, less than half its normal size, with moderately thickened walls and densely bound down by adhesions. The fundus was probably 8 or 10 centimetres from the surface of the abdomen. Upon opening it a small quantity of foul-smelling bile escaped, and at once a piece of drainage tube 8 centimetres long was picked out. Apparently the gall-bladder had shrunken down until it represented an approximate sheath for the tube. No adventitious stones were found, but one end of the tube was filled with stone formation making a partial cast of the tube. An attempt to do a cholecystectomy was only partially successful as the difficulties of the dissection, as well as the impossibility of identifying relationships, made it necessary to leave a more substantial stump than otherwise would have been done, and even then it was necessary to leave an angled clamp on the stump for seventy-two hours. Recovery was smooth and uneventful.

The probable explanation of this mishap is very simple. When the original drainage tube came away a tube of shorter length and likely lesser calibre was inserted into the drainage track without safety pin or other guard. This shorter tube slipped down the track until it came to rest at the lower end of the gall-bladder, and in course of time the drainage track closed above it. Whether the disappearance of the tube was carelessly explained at the time by being lost in the dressings, or whether the interne or surgeon did have some qualms of misgiving is a matter of interesting speculation.

The reporter had not been able to make a search for similar cases in the literature. For obvious reasons, if they exist in any numbers, they are not apt to be dwelt upon except perchance by the lawyers. He had, however, had his attention called to a case recently reported by Arthur Dean Bevan in the Surgical Clinics of Chicago for February, 1920, in which a gauze sponge was removed from a gall-bladder eleven years after the original operation. In this case operation was performed for supposed malignancy which the physical findings seemed to indicate. It is furthermore interesting in that the meshes of the gauze sponge furnished a nidus for stone formation, so that when removed it had the form of a cast of the entire gall-bladder.

STRANGULATED EPIGASTRIC HERNIA

Dr. Calvin M. Smyth, Jr., said that by epigastric hernia was to be understood any hernia through the linea alba, or sheath of the rectus, between the ensiform and the umbilicus. Epigastric hernia is not common, and strangulation of such herniæ is exceedingly rare. Four types of epigastric hernia are recognized: (1) There is a protrusion of preperitoneal fat through a slit in the linea alba. This is not a true hernia in the stricter sense. (2) In addition to the preperitoneal fat, there is a process of peritoneum protruded, thus forming a sac. The sac, however, is without contents. (3) The sac contains all or a part of the great omentum. (4) Both omentum and gut are protruded.

The last type is the rarest and the one less frequently operated upon. This is due in part to the fact that patients suffering from this variety of hernia do not so frequently present themselves for treatment, because they suffer little or no pain. This is in contradistinction to the other types which give severe pain noted by Moschovitz. In reviewing the literature he had found only about fourteen cases of strangulated epigastric hernia on record, and in only five of these did the hernia contain gut. The most recent of these cases was reported by Gatewood in 1910. In his report he states that only four such cases were on record prior to his. To the best of our knowledge the subject of this report is the sixth one.

The explanation, or at least one explanation of the rarity of this condition, may be found in a consideration of the anatomical factors present. The linea alba is a very strong structure composed of dense fibrous connective tissue, the fibres running in three directions. The transverse fibres are the coarsest and the strongest, therefore, most of the defects are in this direction. Another fact to be borne in mind is the tension of the peritoneum in this region in contrast to the comparative flaccidity of the lower abdominal peritoneum. Then, too, the epigastric viscera are of a size which makes herniation unlikely; for example, a defect which would permit of the protrusion of a loop of small gut would not be large enough to allow a loop of transverse colon to escape from the abdominal cavity. Transverse colon is nearly always the portion of the gut that is encountered in these cases. The rarity of this condition would seem to warrant the report of one more case.

The case reported by Doctor Smyth was as follows: A white woman, aged sixty-eight years, para 6, weighs 268 pounds, was admitted to the service of Dr. G. G. Ross at the Methodist Hospital, December 19, 1919, with the chief complaint pain in the abdomen and vomiting.

For the past eight years she has had a mass in the abdominal wall, above the umbilicus. For the past four years it has been gradually increasing in size, and during this period she has worn a combination truss and abdominal binder. The mass always became prominent at night and it has been her custom to replace it each morning on arising. She

has never had any difficulty in accomplishing this until the morning of her admission to the hospital. This morning she was unable to reduce it and sent for her doctor. About half an hour after rising she was seized with a sharp stabbing pain in the epigastrium. The pain was somewhat relieved by vomiting, which she induced. The relief, however, was only temporary, and in the course of the next three or four hours she vomited eight times. The pain became steadily worse. Her physician then ordered her removal to the hospital. No attempt at reduction had been made prior to her admission.

On admission the patient was in a state of exhaustion, although she was not suffering much pain. A mass about the size of a small grapefruit was felt in the epigastric region about four inches above the umbilicus. It projected far out to the right and was hard and immovable. The percussion note was dull. Auscultation of the abdomen disclosed markedly exaggerated peristalsis, and there was a slight distention of the abdomen. An enema which was given proved very slightly effectual.

Operation.—Under ether the abdomen was opened in the midline and the hernial sac was located without difficulty and incised. The opening of the sac was followed immediately by a gush of clear straw-colored fluid amounting to about 250 c.c. The omentum, which had evidently been present in the hernia for some time, was in an advanced state of degeneration. It was adherent to the sac and was freed with considerable difficulty. A loop of transverse colon about five inches long then presented itself, and following this down with the finger, the opening through which the hernia had occurred was located. This opening was found to be a transverse slit in the linea alba which would not admit two fingers. A grooved director was passed into the opening and it was enlarged by cutting upward. The gut was discolored but still retained its resilience, and after the constriction was relieved soon returned to the normal. The gut was then returned to the abdomen and the degenerated omentum excised. The sac was treated in the usual manner. The anterior sheath of the rectus was then dissected up on either side of the opening and for about three inches in the longitudinal direction. The flaps thus made were overlapped and secured by several interrupted mattress sutures. The rest of the wound was closed in the ordinary manner. Uneventful recovery. She was discharged from the hospital on the twenty-first day after operation, and when last heard from was in perfect health. There has been no recurrence of the hernia.

Dr. Morris Booth Miller said that for many years he had, midway between the umbilicus and the ensiform, a little flat tumor about the size of a 25-cent piece which he could feel through the tissues, but which had never given him any direct trouble. Although for some of these years he had digestive trouble, which some of his friends thought was due to duodenal ulcer, this condition was never definitely diagnosed. During the late winter of 1917–1918 while serving on the United States ship *President Grant,* they were subjected to severe weather and considerable exposure on the east bound voyage. During the latter part of that trip he caught a bad cold which terminated in cough. The night after Brest was reached he had an attack of coughing which kept him awake. During the night he was taken with an especially severe paroxysm, during which he felt something in his upper abdomen give way, and noticed that the little flat tumor had grown to the size of an egg. He did not vomit, although he had some nausea, but the tumor was so painful that he could not stand erect. The next morning he was sent to Naval Hospital No. 5 where he saw Doctor LeConte and Doctor Ross. The diagnosis was an incarcerated epigastric hernia, and operation was advised. He returned to the United States and was operated upon at the Naval Hospital, Philadelphia. Dr. W. A. Angwin, the operator, stated that on opening the abdomen he found a small sac which had omentum in it which showed evidences of recent inflammation. The opening in the linea alba was the size of a lead pencil. Uneventful recovery.

THE SURGICAL TREATMENT OF BURNS

Dr. Hubley R. Owen said that he had under his care at the present time a child who, three weeks ago, while melting paraffine, set fire to her clothing and she was badly burned. Her burns would undoubtedly have been much more serious had she not had the presence of mind to fall on the floor and wrap herself in a rug. Her burns extended from above her ankles to her groins anteriorly, and from above her ankles to above her buttocks posteriorly. He saw her four or five hours after she had been burned. In the emergency her father had covered the whole burned area with picric acid, and applied it very freely. This picric acid dressing was removed at the first visit and boric acid ointment applied. In spite of the fact that the picric acid had been applied to the burn only a few hours, she developed symptoms of absorption of picric acid the following day.

Amberine was used for a few days until sloughing developed. It was then discontinued and Dakin's solution applied over the burned area. Dakin's solution was somewhat painful, but cleared the burn up wonderfully. Her kidneys were in good condition, and, under light anæsthesia, the sloughs were cut away. Hypertonic salt solution was tried, but this was very painful and had to be discarded.

He believed the whole secret in the treatment of a burn is cleanliness—not only keeping the burned area surgically clean by removing sloughs, but also keeping the surrounding skin clean. This cleansing is best accomplished under an anæsthetic.

One of the worst burns he had ever had occasion to treat was in the person of a child, in the service of Doctor Wharton at the Children's Hospital, many years ago. She was burned around her abdomen, vagina, thighs, and buttocks. In the treatment of that child a cradle was used to

hold the bedclothes away from the burned area, and an electric light was placed under this cradle to keep the child warm, and keep the burn surgically clean. Of course, at that time Dakin's solution had not yet been devised, but in that case salt solution was used.

Dr. George P. Muller said a good many burns are admitted to his service at the St. Agnes and Polyclinic Hospitals. In association with his assistant, Doctor Ryan, he had tried to reduce the mortality and to improve the methods of external dressing. To understand the phenomena of burns one must consider three factors, namely, shock, toxæmia, and infection. Therefore, from the moment of admission to the hospital the patient, usually a child, must be considered as in a state of shock or on the verge of it. Too often they remain in the receiving wards, which are usually cold and draughty and noisy, to have a preliminary dressing applied before admission to the wards. He tried to have a blanket thrown over the patient and an immediate admission made. The patient's clothing should be rapidly cut away, the patient placed on a blanket and covered with some form of frame for holding electric light, over which another blanket can be thrown. When the electric lights are turned on the body is in a warm chamber, the temperature of which can be regulated at will. The foot of the bed should be elevated, moderate doses of morphine given, and a continuous enteroclysis of salt solution started. Hot drinks and the other accessories useful in shock are added.

Many terribly burned cases come out of shock nicely but die a few days later with manifestations of intense toxæmia. Some have lived several weeks and then died, even though the external surface was clean. They had pushed water to the utmost and had used sodium bicarbonate a good deal, intravenously and by the mouth, but it would seem as though the patients became sensitized and then succumbed from further absorptions of the poison.

To control the infection they had in the last year routinely used dichloramine-T, sprayed upon the burned surface every six hours at first and later every twelve hours. He did not find it hurt the patient after the first spraying if the oil is perfectly fresh. If it smells acrid it should be discarded. Some cases crust up too much and wet dressings are useful for a time. In such cases he protected the surface with paraffine mesh, but had stopped entirely the paraffine film method. One gets just as good results from the perforated mesh and a great deal of time is saved. If an occlusive dressing is needed adhesive strapping is as good as the paraffine film. Fortunately, male adults are usually burned on the hands, face, and neck. There is no difficulty keeping women and children extensively burned on the entire body and trunk under the frame and with no covering.

Therefore, he believed that if the shock is controlled and if attention is paid from the very beginning to the nature of infection, practically all burned cases do well except the hyperacute toxic cases who die apparently for no reason at all. Some German writers have advocated removal of the entire burned area by curettage, but it seemed to him that the trauma and the hemorrhage would offset the advantages.

Dr. John H. Jopson said there is one effect of amberine which he had observed and after no other dressing, and that is very rapid epithelialization over the whole surface. He recalled one man who suffered a typical airman's burn over the surface of his face which was unprotected by his helmet. He was dressed with amberine from the start, and the spread of skin over the surface was very different from that observed ordinarily. Each day it was as if one had used a powder shaker over it. These epithelial cells must have been partially undestroyed, but the protection afforded by the amberine had prevented their being washed off. I think Doctor Lee's contribution is a notable one on sterilization. It would be interesting in these cases to plot out the rate of healing by Doctor Macy's method. Fauntleroy in his paper reporting a large series of burns discusses the value of occasional change of character of dressing, which he calls "switching time." In other words, if we treat these cases by any one antiseptic we find that the granulating surface becomes habituated to that type of dressing and healing slows up. We have seen this exemplified in the sterilization of other types of wounds.

Dr. George G. Ross said that he had an unusual opportunity of observing cases treated by dichloramine-T in the service in France. He was impressed by observing what Doctor Jopson noticed, the islands of epithelial cells growing widely over the granulating surface, as if thrown on by a pepper box; healing was much more prompt and the scars better. A great many burn cases came into the hospital at Brest. He remembered on one occasion an ammunition ship was blown up and sixteen men were brought in, four died immediately. On another occasion six or seven were brought in and they had two to sixteen or twenty men real badly burned all the time. They tried out every known method of treatment and finally came to the conclusion that wide mesh paraffine gauze with dichloramine-T was the most comfortable and easiest method by which a burn could be easily sterilized and unquestionably gave the best type of scar.

STATED MEETING, HELD OCTOBER 4, 1920

THE PRESIDENT, DR. GEORGE G. ROSS, in the Chair

IMPERFORATE ANUS

DR. JAMES H. BALDWIN presented a child, two and one-half years of age, who in August, 1920, was brought to the Methodist Hospital with the statement that it had swallowed a penny some time before, which had not yet been recovered from the stools. Upon examination the child was found to have an imperforate anus with the rectum opening into the vagina through which the fæces were being regularly discharged. In a pouch of the rectum beyond this fistulous opening the coin was found. It was removed through the vaginal fistula. An operation for the formation of a normal anus was contemplated at a future time.

DR. A. P. C. ASHHURST remarked that Rizzoli, an Italian, many years ago (1856) devised an operation for this form of imperforate anus. He claimed that the sphincter of the anus is not at the opening in the anal region, but at the opening in the vagina. Therefore, he dissected the opening in the rectum free from that location, bringing the vaginal opening of the rectum down to the proctodæum.

DR. JOHN H. JOPSON had had the opportunity of seeing and operating on a number of cases of imperforate anus in his service at the Children's Hospital and elsewhere. The cases of rectovaginal fistula constitute the commonest variety. In these cases he had been accustomed to operate when they were first seen, and usually within the first few months of life. The operation is easy as the rectal pouch is near the surface of the perineum, and can readily be brought down and sutured to the skin. There is always a tendency to contraction of the new anus which requires subsequent dilatation to maintain its patency. He had not had the opportunity of following the hospital cases in later life, and of closing the vaginal fistula.

CHONDRO-SARCOMA OF PLANTAR SURFACE OF FOOT

DR. JAMES H. BALDWIN reported the case of a man, aged forty-five years, who had had a growth on plantar surface of right foot for twenty years. Up to two years ago it was about the size of his thumb. Since then it increased until it was the size shown in the photograph (Fig. 1), and he was compelled to walk on the side of his foot. The tumor was subcutaneous, had a capsule of its own, and was easily shelled out. When

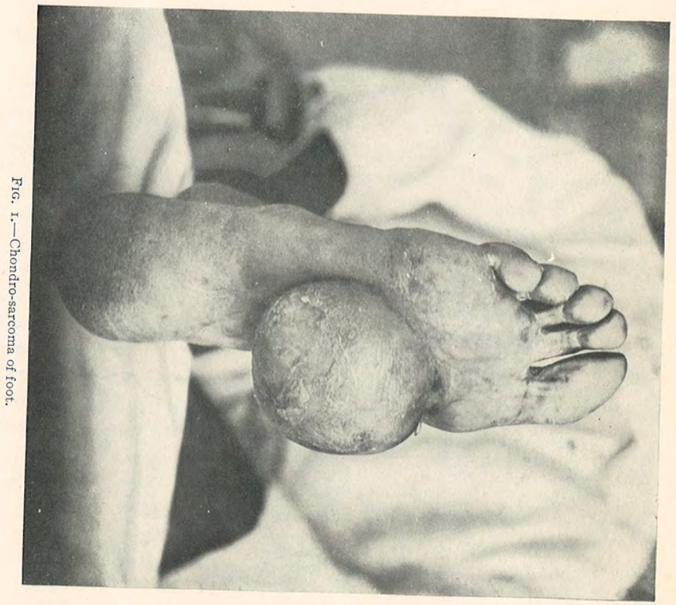


FIG. 1.—Chondro-sarcoma of foot.

removed the flexor tendons were exposed. The wound healed without complications. The excision was done September 2, 1920. The pathological examination made by Doctor Russell Richardson shows this to be a mixed tumor, a chondro-sarcoma, a form of tumor, while not uncommon, he had not seen or heard of in this location. They probably arise from embryonal cells capable of producing more than one type of adult tissue and may descend from one or all layers of the embryo. They usually represent two, or at most three, types of cells.

POST-OPERATIVE ENDOCRINE DEATH

Dr. George G. Ross reported the case of a woman who was admitted to the Methodist Hospital in April, 1920, on account of persistent vomiting. She had been ill about two weeks. The attack began with a severe chill lasting for about fifteen minutes, followed by persistent vomiting and bleeding from the vagina, lasting for two days. She did not pass any clots or shreds that indicated interrupted pregnancy. She also stated that at the very beginning of her attack she was jaundiced. Her bowels had been moving regularly. At the time of admission she complained of slight epigastric pain. She had suffered from indigestion for years. She had no symptoms referable to the cardiac, renal, nervous, or pulmonary systems.

When admitted her temperature was 97°; pulse, 100; respiration, 26. She was a very weak, sick-looking, emaciated white adult of twenty-two years. The skin was hard and very dry, mouth dry and tongue red. The conjunctivæ were pale. The patient's general appearance was one of a moderately advanced case of inanition. The thing that was the most striking was the impression she gave of being very much in need of fluids. There were no abnormalities about the head or neck. The tonsils were chronically diseased. The heart was negative except for a slight acceleration. The lungs were negative. Abdomen was soft throughout, no marked rigidity. There was a mass about the size of a lemon in the right upper quadrant under the costal margin. It moved downward with respiration, but was not movable otherwise. On account of the extreme thinness of the abdominal walls the mass could be palpated from the loin, but could not be pushed into the kidney pouch. The abdomen was otherwise negative except for slight tenderness on deep pressure over McBurney's point.

Blood.—Red blood-cells, 3,920,000; white blood-cells, 15,000. Heart-beats, 80.

Urine.—1020, acid, trace of albumen, no sugar, no casts.

The treatment for the vomiting having failed and as the woman was rapidly growing worse, it was decided to open her abdomen, as it was hoped the tenderness over McBurney's point and the leucocyte count indicated a low-grade inflammation of the vermiform appendix, and its removal would control her only symptom, vomiting, and that the incision in the abdomen would afford an opportunity to establish the character of

the tumor. Operation by Doctor Ross. Right rectus incision. Gall-bladder normal. Stomach normal, pylorus patulous, duodenum normal. The mass felt upon abdominal palpation was found to be the right kidney displaced downward and forward. It could not be replaced in the kidney pouch. The left kidney was movable. There were adhesions about the cæcum, the appendix was thickened and sharply angulated in the middle. The appendix was removed in the usual manner. The pelvis was inspected and found negative. The peritoneum had no fluid in it and the rectus muscle had the appearance of dried beef. The abdomen was closed without drainage.

The patient reacted well from the immediate effects of the operation. She was given 1000 c.c. of salt solution by bowel before leaving the operating room, and after returning to the ward was given continuous proctoclysis. She recovered from the ether with no vomiting and as soon as she asked for water it was given her. She did not vomit this. The first twenty-four hours after operation were uneventful and the patient retained all the fluid that was given her both by mouth and by bowel. At the end of this time her pulse and temperature rose rapidly from 100 and 99°, respectively, to 170 and 106°. She had passed both gas and fæces since the operation and had voided 50 ounces of urine. In spite of ice packs the temperature and pulse continued to rise and the patient died in a convulsion about thirty-six hours after operation.

Doctor Ross reported also the case of a woman who was operated upon in 1918 for repair of the cervix and intra-abdominal shortening of the round ligaments. Patient had had an attack of abdominal pain two weeks before her admission to the hospital. On the fourth day of this attack she had a severe uterine hemorrhage confining her to bed. There was a temperature of 101°. She vomited foul-smelling, brownish material. On the fifth day she experienced relief from the pain upon the passage of flatus and fæces as a result of an enema. The vomiting stopped immediately. A day before admission she had a recurrence of her symptoms. A diagnosis of incomplete intestinal obstruction was made, and for the second time her symptoms were temporarily relieved by an enema. An appendectomy had been performed twenty-two years ago.

Previous medical history, family history, and social history negative. Physical examination negative—except for a general tenderness of the lower abdomen, especially marked on the left side. Vaginal examination demonstrated a slight bloody discharge. The cervix was enlarged, soft, and the os dilated. The uterus was enlarged and tilted to the left and was fixed in this position. There was a left-sided pelvic mass the size of the fist which was tender to palpation.

Ten days after admission she was operated upon for a fibroid uterus and a sub-total hysterectomy was performed. This was attended by considerable difficulty, owing to the fact that the bladder was adherent to the

fibroid uterus in front and sigmoid behind. The left ovary and tube were badly diseased and were adherent in the pelvis behind the broad ligament. It was necessary to dig the ovary out of its adherent bed. There was little or no hemorrhage. The wound was closed without drainage. The operation took one hour and a half. At the termination of the operation her pulse was 135; skin was dry and warm; color of mucous membranes, pink. A few hours after she was returned to her room the temperature began to mount rapidly until it reached 104 2/5°, ten hours after operation. An ice pack of two hours reduced the temperature 2 degrees. Within fifteen minutes after its discontinuance the temperature had reached 105°. Seven hours later the temperature was 107° and the pulse uncountable. Patient became unconscious and died. Patient developed slight distention. There was active peristalsis. She passed flatus and fecal matter as a result of an enema.

This death is one that is compared with that which occurs in the toxic goitre. Doctor Ross believed these two cases to be deaths due to chemical toxæmia, a result of hyperactivities of the ductless glands, probably of the adrenals.

In the second case it is possible that the traumatism caused by the removal of the ovary may have liberated a chemical toxin which, being driven into the circulation, might account for the subsequent events.

Dr. H. R. Owen said that two or three years ago, during the month of August, he operated on a child at the Orthopædic Hospital on an excessively hot day. The temperature in the operating room must have been over 100°. The operation was tendon transplantation—an operation which should have been postponed until a cooler day. During the operation he noticed that the patient became very flushed and the skin felt very hot, and was not perspiring. The child's temperature was taken and found to be 106°. Pulse was running between 140 and 150. Both temperature and pulse had been normal previous to the operation.

He believed that this child suffered from a heat stroke. The child was very ill for about forty-eight hours, but recovered.

The moral this case taught him was never to operate on any case, excepting an emergency, on an excessively hot day.

He did not know whether Doctor Ross's two cases were in the same category as this case, but when he stated that one of his operations had been performed in August, Doctor Owen recalled this case of heat stroke, which he feared for twenty-four or forty-eight hours was going to terminate in a fatality.

Doctor Ross rejoined that he was familiar, as all are, with the sunstroke which may occur during operation, having seen it develop with the patient on the table. These two women complained of great heat while their extremities were cold; there was a peculiar expression about the face and there was semiconsciousness. The first woman died with con-

vulsions. He had been groping for some plausible explanation of the phenomena presented and had thought of the endocrine theory only because it seemed to him to be about as reasonable as any other.

ACUTE PANCREATITIS COMPLICATING PREGNANCY

Dr. W. P. Kroger (by invitation) reported the following case of acute pancreatitis complicating pregnancy on account of its extreme rarity. The patient, a married woman, twenty-four years of age, and seven months pregnant, was admitted to the Lankenau Hospital in August, 1920, to the service of Dr. George Ross. Her chief complaint was acute pain in the upper left abdomen. Her health had been very good until two weeks before admission to the hospital, when she took a long automobile ride. Following the trip she began to notice mild, generalized, abdominal discomfort. She felt tired and vaguely ill. Two days previous to entering the hospital she developed sudden pain in the upper left abdomen. This pain gradually became more severe and in twelve hours it was very acute. She then began to vomit and continued to vomit frequently and profusely. At first there was a little blood in the vomitus which she thinks may have come from her throat. Later the material became dark green or brown. No fecal odor to this material. No purgative was given and several enemas gave only a slight result. The pain continued to be severe, she became very weak and was sent to the hospital.

There was nothing of importance in the past medical history. Her menstrual history was negative and she had one healthy child.

Examination revealed an obese adult. Skin was cold and clammy and she was evidently in a condition of shock. The pulse was weak, running about 160. The temperature was subnormal, about 97°, and the respirations were 36. Her blood-pressure was 96 systolic and 64 diastolic. The head was normal. Face was pale and the tongue was heavily coated. The neck was negative. Aside from rapid rate, the heart was in good condition. The lungs were clear. The abdomen was distended with a pregnant uterus. There was moderate tenderness throughout the upper abdomen, especially on the left of the midline. No rigidity was noted and no masses were felt. Peristalsis was diminished. The uterus was enlarged, hard, slightly tender and freely movable. The vaginal examination was negative. The extremities were cold.

A blood count showed 80 per cent. of hæmoglobin, 5,000,000 red cells, 30,000 white cells, and 90 per cent. of polymorphonuclears. The urine contained no sugar, a slight amount of acetone and diacetic acid, and a few granular casts.

About six hours after her admission the patient complained of severe pain in the lower abdomen and she suddenly aborted a dead fœtus with the membranes intact. Following the abortion she became much weaker, her temperature arose to 103°, and the pulse became very rapid. Her condition continued from bad to worse, she became cyanotic, and twenty hours after entering the hospital she died.

An autopsy was performed. Upon opening the abdomen a considerable amount of dark brown fluid was noted, the "beef broth" fluid of pancreatitis. The stomach and upper intestines were dilated. The lower ileum was markedly constricted. The omentum contained many white areas of fat necrosis. The pancreas was acutely inflamed and showed almost total destruction by necrosis. The liver, gall-bladder, and other abdominal organs were apparently normal. The microscopic sections showed acute suppurative hemorrhagic pancreatitis and fat necrosis of the omentum.

When making a diagnosis of this case a number of conditions should be considered. Chief among these are acute cholecystitis, acute pancreatitis, perforated peptic ulcer, and acute intestinal obstruction.

Doctor Gatewood, of Chicago ("Surgical Clinics of Chicago," vol. iv, No. 4, page 801, August, 1920), reports a case similar in some respects to this one, but in his case the initial symptoms occurred directly after pregnancy. He operated upon his case, draining the pancreas and the gall-bladder. His case recovered. He advises operative interference in all cases. Other than this no similar cases could be found in the literature.

Dr. George G. Ross said that this woman was sent into the hospital with the diagnosis of acute perforation of the stomach or duodenum. I could not satisfy myself that such was the condition. The woman's pregnancy obscured the situation. He was unable to make a diagnosis, but was able to stay his hand, and the post-mortem proved the wisdom of not doing anything, for the whole pancreas was sloughed away.

ISOLATED FRACTURE OF THE LESSER TROCHANTER OF THE FEMUR

Dr. E. B. Hodge reported the history of a woman, aged seventy-four years, who was admitted to the Presbyterian Hospital with a diagnosis of "broken hip." She had become dizzy and fallen on her left side. There was tenderness over inner upper left thigh, slight eversion and no shortening. X-ray showed a fracture of the lesser trochanter. The leg was treated by light extension with the thigh in moderate flexion. X-ray one month later showed satisfactory callus. Ashhurst, "Principles and Practice of Surgery," Second Edition, quotes Metcalf as having in 1915 collected seventeen cases of isolated fracture of the lesser trochanter.

Dr. George G. Ross said that he had seen two cases of fracture of the lesser trochanter, both in baseball players. The injury had occurred in their effort to recover their balance after having missed the ball. Both were dressed with partial flexion.

ISOLATED FRACTURE OF THE TUBEROSITY OF THE ISCHIUM

Doctor Hodge also reported the case of a man, aged forty-five years, who was admitted to the Presbyterian Hospital in March, 1920. He had

fallen 40 feet from a tree, landing full on his buttocks upon a macadam roadway. There was considerable shock. No gross injury could be found except a tender swelling in the region of the right tuberosity of the ischium. X-ray showed fracture at this point only. Besides the rarity of the fracture, a point of interest was the high degree of paresis of bowel and bladder. Early in the case the diagnosis of rupture of the bowel had to be seriously considered. There was ultimate union and patient walked out of the hospital in seven weeks. He has, however, not yet recovered from the effects of the shock to his nervous system.

W. D. Haines (ANNALS OF SURGERY, February, 1920), in recording an instance of isolated fracture of both tuberosities, states that search of the literature showed no record of an uncomplicated case. Ashhurst, *loc. cit.*, states that the tuberosity has been detached by muscular violence. Haines properly emphasizes the importance of rectal approach for diagnosis and reposition of fragments.

GUNSHOT WOUND OF THE SHOULDER

DR. JOHN H. JOPSON presented a woman seen at the Presbyterian Hospital. She had been shot the previous evening at close range by a 38-calibre revolver, the bullet entering on the left side at the anterior border of the deltoid muscle, near the apex of the axilla, and lodging in the bone at the level of the base of the greater tuberosity. There was no evidence of vascular or nerve injury. The usual operation of *débridement* was done. The ball had traversed the deltoid muscle and lodged in the bone. It was removed from this bed, and found to be partially wrapped in a portion of cloth from the patient's dress. Cultures were taken from this. Owing to the length of time elapsing since the wound was received, twenty hours, it was not sutured, but packed with Dakin gauze. This was removed at the end of twenty-four hours, and the Carrelling of the wound begun. Cultures and counts were made from the wound on the second day. Laboratory reports were as follows: From the cloth wrapped about the bullet two organisms were obtained, *viz.*, a Gram-positive bacillus unidentified, and colon bacillus. From the wound two days later, a Gram-positive bacillus, non-spore bearing, identified culturally as the Hay bacillus, and present in the proportion of 1.5 organisms per field. With these reports the completion of the suture by the delayed primary method, was undertaken with complete confidence. On the third day, after anæsthesia and complete preparation of the field antiseptically, including iodine, the deep structures were approximated with chromic catgut, and the skin edges with silkworm-gut. No drainage. Three times was the patient anæsthetized. Primarily with ether; the Dakin packing was removed while under Savariaud, and the final closure was made under nitrous oxide gas. The case was a demonstration in civilian practice of the applicability of the lessons learned in many thousands of cases during the war. The result was a perfect one, and the

period of disability negligible after her discharge from the hospital twelve days after injury.

MIXED TUMOR OF KIDNEY

DOCTOR JOPSON also reported the history of a little girl of three years, and exhibited the specimen removed. The child had a negative family history, and enjoyed good health until six weeks before her admission to the Presbyterian Hospital. At this time she began to be peevish and fretful. One week before admission her mother while lifting her noted the presence of a tumor in the right side of the abdomen. Examination of the urine showed the presence of red blood-cells, and the child was seen to be anæmic.

On admission to the hospital she was in fair general condition. The blood report showed red blood-cells, 3,650,000; whites, 10,085; hæmoglobin, 48 per cent. The urine report was as follows: Specific gravity, 1022; reaction, acid; sediment, slight flocculent; albumen, very faint trace; sugar absent; red blood-cells in small amount, and white cells more numerous. A large tumor was readily detected on the right side extending several inches below the costal margin, and visible, palpable and movable. No evidence of metastasis could be found. The tumor was evidently of rapid growth, as the mother was an observing woman, a trained nurse, and the widow of a physician, and it had only attracted her attention a week before.

Four days after admission a transperitoneal nephrectomy was done through a right rectus incision. The large tumor was adherent to the subperitoneal structures, and ruptured while being lifted and separated. Some thick gelatinous degenerated tumor content escaped. There was no bleeding to speak of, and the operation was simple of execution. There was considerable shock immediately following removal. The wound was closed without drainage. Reaction was rapid, and convalescence smooth.

Two weeks after operation the patient was subjected to radium treatment by Doctor Newcomet at the Oncologic Hospital. After which she was sent home in good condition. For about six weeks she seemed in fine health, gaining weight, of good color, playing, and in fine spirits. She then again became peevish and languid, her appetite failed, and she complained of pain in the abdomen. There was no definite demonstrable sign of local recurrence, although this was suspected. There was a short period of acute illness, with vomiting and collapse before death which occurred on September 8th, two months after operation, and a little longer time after detection of the condition.

The pathological report by Doctor Speese is as follows:

Specimen consists of a kidney which measures 16 x 8 x 7 cm. The external surface is smooth. For the most part the growth is mushy and presents a soft reddish-white mass which in places has undergone necrosis and shows much hemorrhage. On cross section a portion of the kidney cortex measuring 1 x 3 cm. in diameter is apparent.

Elsewhere the kidney tissue is destroyed. Microscopic examination shows a very cellular growth composed of small cells, spindle in shape, which are closely packed together, particularly in the region of the blood-vessels, the walls of which seem to be formed of tumor cells. The stroma in this region is scant, but elsewhere is well developed. The sarcomatous elements predominate, but a few atypical gland formations are seen, which indicate that the growth belongs to the *mixed tumors*. Extensive areas of necrosis and hemorrhagic infiltration are encountered. The kidney tissue which persists is the seat of hyaline degeneration and cloudy swelling.

The fatal outcome of the case, illustrating, as it does, the exceptional malignancy of this type of tumor, corresponds with what we have observed in all the cases coming under our attention. Albanan could find but seven cases in which a child survived operation longer than three years. The classical case of Abbe, which carefully traced from childhood to adult life showed no recurrence, illustrates the very rarely obtained cure, and at the same time demonstrates that this is within the realm of possibility.

A second case was reported by Doctor Jopson, a tumor of the kidney occurring in an adult male, aged forty-eight years. The tumor had existed at least eight or nine years. It was discovered at that time by a physician during the course of an examination to determine the cause of vague symptoms in the way of discomfort in abdomen and back. The surgeon at that time informed him he had a floating kidney. The symptoms, which he describes as a heaviness in the right iliac region, and pain in the lumbar and sacro-iliac regions, have increased somewhat in severity, and the tumor has probably increased in size. Moreover, he has become somewhat neurasthenic concerning himself and his condition. He also describes a bloated feeling and has some diarrhœa. His general health has been good, and he has worked steadily at his trade of inspector of air brakes. He was referred to the Presbyterian Hospital by Doctor Steinmetz.

His family and previous history aside from the above are negative. His general condition is good. Weight is 145 pounds. In the right side of the abdomen is a large tumor, occupying the hypochondriac and lumbar regions, the size of a child's head. Owing to the relaxation of the abdominal wall, it is visible as well as palpable, moves with respiration, and with the patient in the left lateral decubitus falls to the left side. Bimanual examination shows extension to the loin space. It is insensitive, of smooth surface, and semi-cystic in consistency.

X-ray examination by Doctors Newcomet and Steinmetz shows the ascending colon displaced far to the left, and the stomach pushed upward. They believed they could outline the right kidney separate from the tumor. Urine report: Specific gravity, 1016; sediment, none; albumen, none; sugar, none; microscop., 2" ? and few epithelial cells; very few hyaline casts. Functional P.S.P. test, (1) Amt. 40" P.S.P. 15. (2) Amt. 60" P.S.P. 25.

Blood examination: Red cells, 4,810,000; leucocytes, 10,500; hæmoglobin, 91 per cent.

Operation, September 3, 1920: Long right rectus incision from ribs to below navel. Palpation shows opposite kidney normal, and no intraperitoneal pathology. Ascending colon displaced by tumor much to left. The thin external layer of the ascending mesocolon was split. Numerous perinephric adhesions were divided, the tumor was lifted out of the abdomen, and found to spring from the lower pole of the kidney, which was fused with it. The ureter was clamped, divided, and cauterized after ligation. Two large clamps were applied to the proximal side of the vascular pedicle, one to the distal side, the pedicle was divided, and the tumor removed. Vascular adhesions and pedicle were ligated. The posterior peritoneum was sutured. The abdominal wound was closed in layers, using chromic catgut. No drainage. After operation the patient did well for three days. He could not void, and was catheterized at regular intervals, passing large amounts of urine of normal character. On the second night, being uncomfortable, he sat up twice on the edge of the bed in an effort to void. On the evening of the 5th of September he vomited, and this persisted through the night and the following day. The patient was partially collapsed with thready pulse, cold skin, and seemed very ill. The dressings were dry. Stomach washings gave temporary relief. In the afternoon inspection of the wound showed that the deeper stitches had given away, and there was nothing but skin stitches holding. The wound was reopened, the intestine covered by omentum reduced, the peritoneum found perfectly clean and sterile. The wound was resutured under gas, and the patient pronounced himself a short time later as feeling relieved, as indeed he was. His condition at once improved, all symptoms of peritoneal irritation disappeared, and he gave no further cause for anxiety.

Report on specimen by Dr. John Eiman is as follows:

Gross: Kidney and tumor attached to the lower pole. The kidney and tumor weigh 1380 grams, and measure 21 x 11 x 8.8 cm. The tumor mass is roughly spherical, and measures 14 cm. in diameter. The lower half of the kidney is split in the median line and the tumor is wedged in the kidney tissue. The kidney is pale purple in color and fairly firm in consistency. The tumor is reddish yellow in color, elastic in consistency and feels like a huge cyst. The surface of the tumor is covered diffusely with fibrous adhesions and shows numerous large distended vessels and a network of finer vessels. On pressure over the tumor there exuded from the renal vein a few c.c. of dark red blood. The renal veins show no gross lesions.

Specimen was opened after hardening for about two weeks. On cross section it showed a solid tumor mass attached to the lower pole of the kidney. The tumor was surrounded by a definite capsule which varied in thickness from 1.5 to 2.5 cm. In that portion of the capsule which separates the kidney tissue from the tumor were seen huge irregular blood-channels which in some places measure 2 cm. in diameter. The tumor was elastic in consistency, dirty grayish yellow along the periphery, and bluish black in the centre. (The dark discoloration probably due to faulty fixation.) Roughly in the central portion of the tumor is a stellate core made up of fairly dense fibrous tissue.

Microscopic Diagnosis: Hypernephroma. Grawitz type.

SUPRACONDYLOID FRACTURE OF FEMUR

Dr. John H. Jopson reported a case of supracondyloid fracture of the femur complicated by fracture of the tibia and fibula on the same side, treated by tongs extension. He exhibited lantern slides showing stages of reduction of the fracture. The patient, a male aged forty-two years, injured in a railroad accident and admitted to the Presbyterian Hospital, had the lesions mentioned, and additional complication to treatment in the shape of abrasions around and above the knee, at the points where it was desired to apply the tongs extension. He was therefore somewhat in the position of a battle casualty, as the chances of infection were materially increased by applying the extension at these areas. The skiagrams showed an oblique fracture about 4 inches above the articular surface, the lower fragment rotated backward and pulled upward in the manner common to this fracture. The end of the upper fragment was in contact with the upper margin of the patella. There was an oblique fracture of the tibia, and a transverse fracture of the fibula, in fair position, in their lower thirds.

In view of the abrasions, tongs traction was first applied to the tibial tuberosity, in accordance with Blake's teaching, and twenty pounds weight applied, the knee flexed and supported in a combination of Thomas and Cabot splint to fix the fracture of the tibia and fibula. This treatment was ineffectual in bringing about reduction, although some separation of the fragments was obtained. Seven days after injury, the skin wounds having healed, the tongs were applied above and anterior to the axial centre of the condyles, and twenty-four pounds weight applied. A few days later another X-ray showed reduction almost complete. To assist in overcoming the backward displacement and downward pull of the gastrocnemius muscle, upward traction by a canvas cuff above the knee with a pull of eight pounds was used. Later the line of extension through the tongs was raised to lift the lower fragment into line with the shaft of the femur. Slight lateral displacement amounting to one-half inch persisted. Tongs were removed after six weeks. Knee exercise was hampered beyond that obtaining in the ordinary type of similar cases by reason of the complicating fractures of tibia and fibula. At the end of eight weeks, when apparatus was removed, there was limitation of knee movement to 25 degrees. This improved rapidly, and at time of discharge, nine and a half weeks after the injury, it was inconsiderable.

Doctor Jopson said that the suspension method of treatment of fractures, which is sometimes known on the continent as the American method, has largely displaced the operative treatment of fractures of the upper and lower extremity alike. It renders it unnecessary in a very large percentage of fractures which resisted reduction by the old methods, and which were therefore considered as suitable cases for plating, slide-grafting, or open fixation by other methods. Its advantages, now gen-

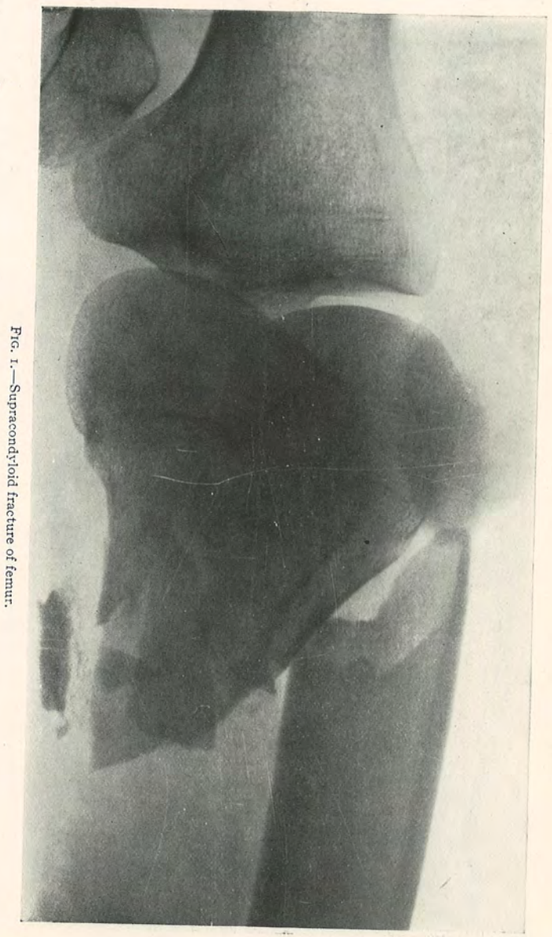


Fig. 1.—Supracondyloid fracture of femur.

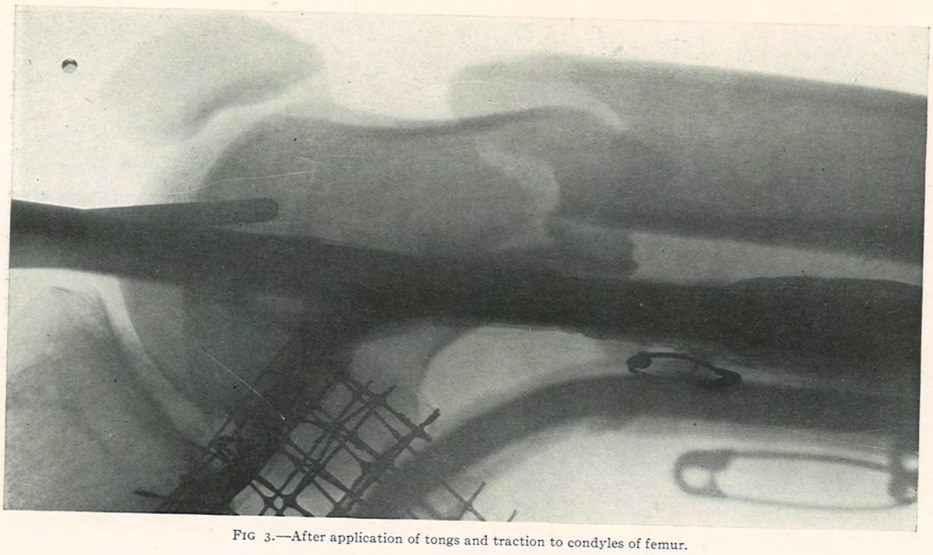


FIG 3.—After application of tongs and traction to condyles of femur.

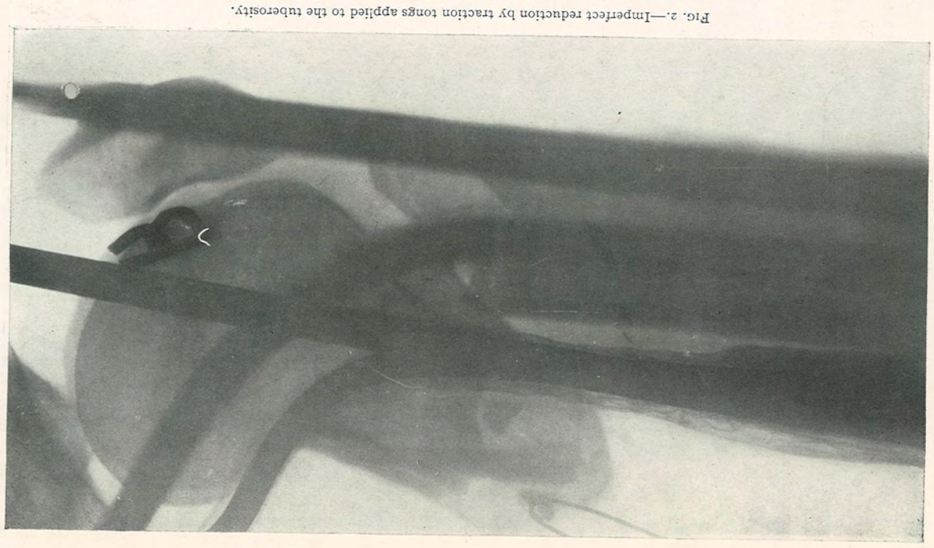


Fig. 2.—Imperfect reduction by traction tongs applied to the tuberosity.

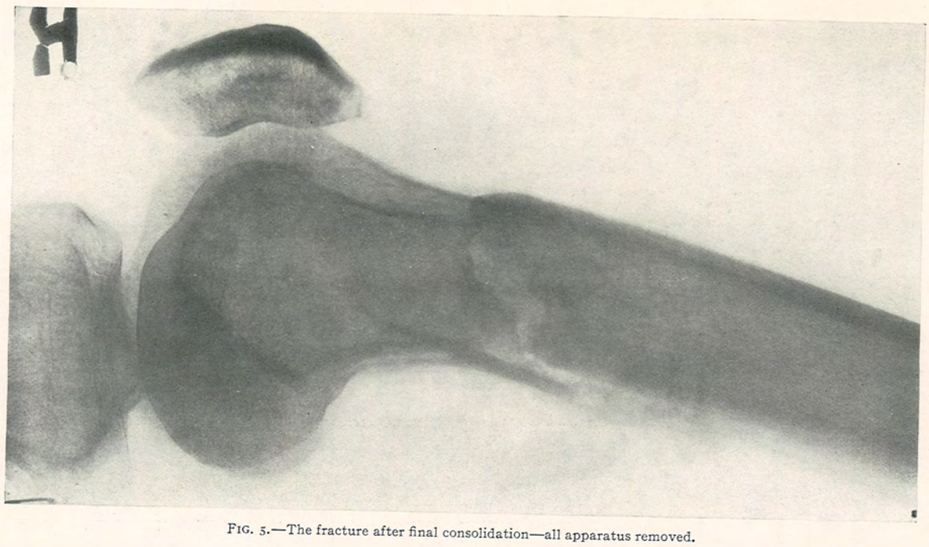


FIG. 5.—The fracture after final consolidation—all apparatus removed.

FIG. 4.—Showing further correction by elevation of tongs and traction after partial reduction.

erally recognized, are (1) that it secures relaxation of the deforming muscles of the fractured member, and this relaxation, produced in part by posture, when increased by a combination with traction applied by one of several methods, permits the bone fragments to fall into their proper relation. (2) It permits of mobilization of the joints of the part from the moment of beginning treatment, and thus insures prompt recovery and preservation of function, without the atrophy of muscles, and crippling adhesions which only too frequently were the bane of the surgeon who treated fractures by the non-operative or operative methods. (3) Permitting of functional rest, it also permits change of posture and relieves pain. (4) Circular constriction of the limb is avoided, and (5) in all cases of compound fracture, infected or clean, access to the wound and ease and comfort of dressing are facilitated to a degree possible by no other means. The recognition of the advantages of continuous traction by weight extension, of skeletal traction as contrasted with the Buck's extension or strips glued to the skin, naturally followed the general adoption of the suspension method in large series of cases during the war. It appears, however, that a considerable number of surgeons have been slow to give up the practice of open operation in certain of the rarer fractures, and that they would profit by a careful study of the papers of Blake, Lyle, and their assistants and associates, and would perceive the possibility of a wider application of the principles which they have emphasized. In this connection we would like to present the following series of slides showing the possibilities of treatment in supra-condyloid fracture of the femur.

FRACTURE OF TIBIA AND FIBULA WITH NON-UNION TREATED BY OPEN OPERATION AND TONGS EXTENSION

Dr. John Speese showed the X-ray plates of a fracture of the tibia and fibula which he thought would be of interest in conjunction with Doctor Jopson's remarks. The fracture of six weeks' duration was so firmly fixed and overlapped that open operation and mobilization of the ends was necessary. The wounds were closed, tongs extension applied to the malleoli, and the leg placed in a Thomas splint. A second X-ray taken five days later showed satisfactory reduction, the slight eversion of the lower fragments was readily corrected by changing the line of extension.

While the use of tongs extension is admirably adapted to the correction of such fractures of recent occurrence, it has a distinct advantage after open operation has been resorted to. Its use in such cases insures reduction and avoids the more prolonged and dangerous operations of fixation of the fragments by metal plates or bone grafts.

Dr. George P. Muller said that a number of cases had been treated by " tongs extension " in his wards during the past few months and they have been much pleased with the results. The method seems to be without serious inconvenience to the patient, only in one case did any trouble

occur, and in this some skin necrosis resulted from improper introduction of the tongs. He believed that the method will be of particular use not only in curing deformity as seen in the case reported by Doctor Jopson, but also in difficult cases of comminuted fracture in the lower third of the leg. He thought it would be simpler and more satisfactory to use the metal plate in cases of fracture high in the shaft of the femur.

Dr. George M. Dorrance said that he had had some experience with the use of tongs in Evacuation Hospital No. 1. Most of the fractures where he used the tongs were compound. In the ordinary case he does not find it necessary to use the tongs, if the Thomas splint is correctly applied. In supracondylar fractures, he had used the tongs in three cases. It has the added advantage that one can flex and extend the leg, thus avoiding the stiff knee-joint that commonly follows the old methods of treatment.

Doctor McKnight said that in the use of the Steinman pin he had had few infections. Riedel reports forty cases of fracture of the femur and lower leg treated in this manner, and in only four did he have delayed healing of the pin openings, one for four months and the others for fifteen weeks, and these were in alcoholics. The Groves modification of the Steinman apparatus is more efficacious when the extension is to be applied to the cancellous end of bones. This consists of a small triangular plate with three pins a quarter of an inch long. They are inserted into the condyles and are less apt to tear out or injure bony tissue than the tongs. In fracture dislocations of the ankle with anterior displacement a partial tenotomy with direct bone extension is the best treatment in this rather difficult deformity. In applying the tongs the skin should be retracted upward to prevent direct pull on the soft tissues. This method of fracture treatment is not brutal nor so painful as indirect traction of twenty or thirty pounds pull on the muscles, tendons, and ligaments as occurs in Bucks' extension.

SUSPENSION TREATMENT IN FRACTURE OF THE PELVIS

Dr. John H. Jopson exhibited a slide (Fig. 1) illustrating the application of suspension apparatus as devised and used on Doctor Jopson's service by one of his former assistants, Dr. Douglas P. Murphy, for treatment of fractures of the pelvis. This particular patient, under Doctor Hodge's care in the Presbyterian Hospital for a fracture of the pelvis, complicated by rupture of the urethra, was a severe test of the method, and Doctor Hodge pronounced it satisfactory. Doctor Jopson had used it in several cases, including a fracture of the pelvis, with multiple lines of fracture, anterior and posterior, in a child of five years. This case, submitted to exploratory laparotomy by Doctor Speese, and later suffering from extensive sloughing of the skin and subcutaneous tissues of the back, from the fracturing force, was handled with ease by suspension in this manner, until the bones had united. All adult patients in whom it had been used voiced their satisfaction with it.

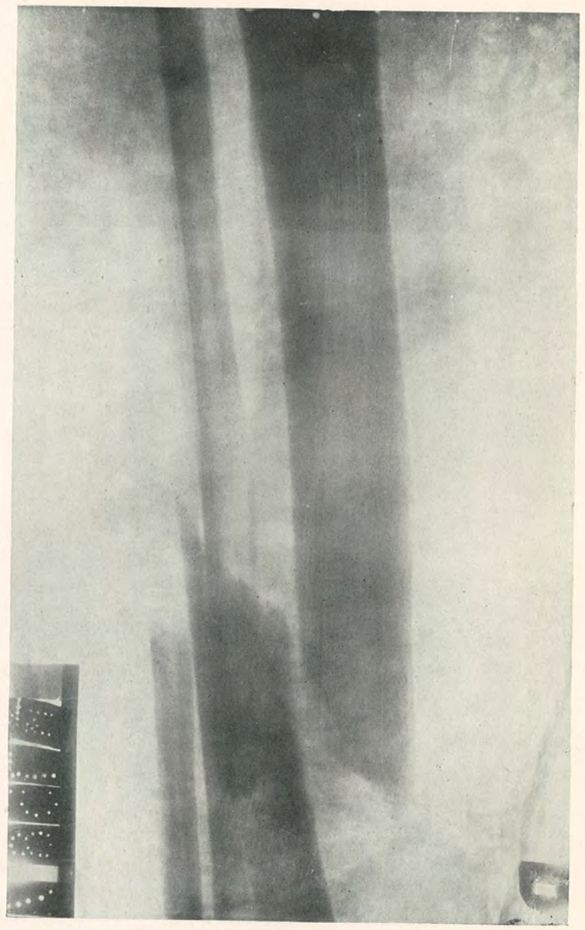


Fig. 1.—Fracture of tibia and fibula before application of tongs.

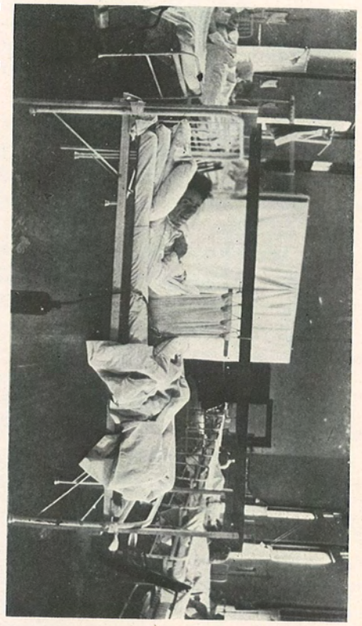


FIG. 1.—Fracture of pelvis (bilateral) with rupture of urethra and suprapubic drainage (Doctor Hodge's service). Treatment by suspension and satisfactory results from all standpoints.

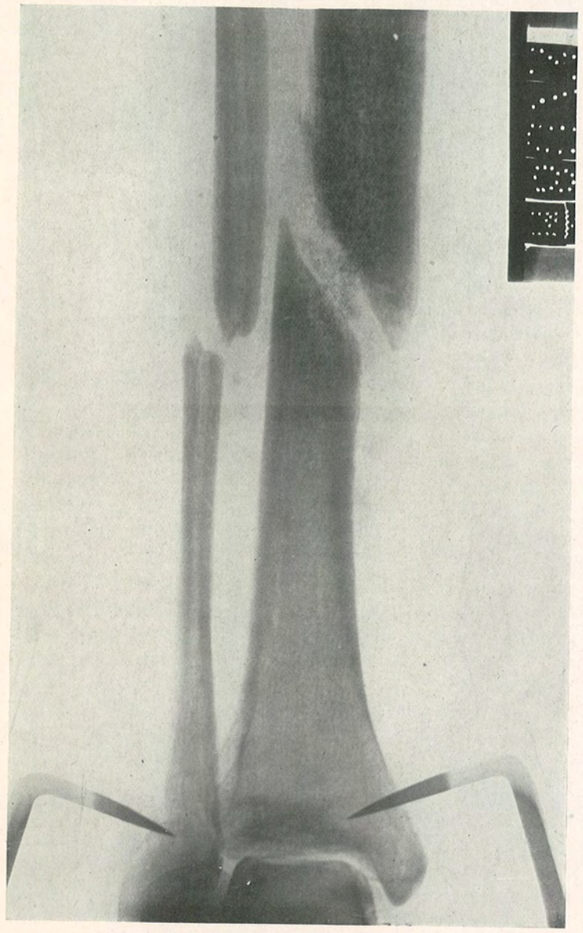


FIG. 2.—Reduction by tongs extension.

CONGENITAL STENOSIS OF THE COLON

Dr. H. P. Brown reported a case of congenital stenosis of the colon, sigmoid and upper rectum in the person of a female infant who was admitted to the service of Doctor Jopson at the Children's Hospital, June 18, 1920. She was in fair condition when born; had one black meconium evacuation after birth.

She began to vomit on the morning of the fourth day, day of admission, and continued doing so all day. The vomitus was dark green and fecal in character.

On admission the temperature was 100°; pulse, 150; and respiration, 42.

Examination shows a fairly well-nourished child in rather poor condition. The head and chest are apparently normal. The abdomen is somewhat distended and a little firmer than usual. There is not any palpable mass present. The rectum admits the little finger up to the first joint without detecting anything abnormal.

Operation (10.30 p.m. day of admission): A 3 cm. incision was made below and to the left of the umbilicus, through the rectus muscle. On opening the abdomen free fecal material was evacuated. The small intestine was considerably distended, and of a dusky red color. A small mass was palpated in the region of the lower sigmoid, but it could not be exposed. The large bowel could not be identified. A distended loop of bowel was brought into the wound, its mesentery transfixed with a glass rod, the bowel opened and evacuated, and sutured to the wound. The abdomen was drained and closed.

The child left the table in fair condition and died three hours later.

At autopsy, the peritoneal cavity was filled with fæces. The opening of the enterostomy was in the small intestine, about 24 inches from the pylorus. The small intestine was greatly distended, and showed a gangrenous perforation in the jejunum, about 1 inch in diameter, 12 inches from the pylorus. The bowel at the site of perforation had been especially distended before it ruptured. The mesenteric lymph-nodes were considerably enlarged. The cæcum was in the right iliac fossa, small and firm, and had a small appendix attached. The entire colon, including the sigmoid and rectum to within 2 cm. of the anus, was hard and firm, and cord-like in character, and approximately 0.4 cm. in diameter. The lumen would admit only a small probe, and section showed that it contained a small amount of clear jelly-like material.

Weiland,[1] quoting from Thremin several years ago, states that of 111,451 patients in the Vienna Foundling Hospital, there were only two cases of congenital occlusion of the intestine.

Lockwood,[2] in the St. Bartholomew's Hospital reports, states that in 16,030 surgical cases, 19 were for colotomy, which was fatal in 12 cases.

[1] Weiland: Med. News, New York, 1896, lxviii, p. 44.
[2] Lockwood, C. B.: St. Bartholomew's Hosp. Reports, vol. xix, 1883.

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Twice the great intestine could not be found. In one of these cases there was no post-mortem, and the other showed absence of the ascending colon.

Quoting from Sir Chas. Ball:[3] The hind gut is all that portion behind the communication with the yolk sac, which eventually forms the entire large intestine and portion of the ileum. In the adult, no indication of what was formerly the mid gut normally remains, but its position is not infrequently marked by congenital malformation—Meckel's diverticulum —which is usually found in the ileum tolerably near its termination. If then the hind gut has not developed, we find the rectum and other portions of the intestine absent in whole or in part, or rudimentary, and the small intestine ending in a cul-de-sac, or having an opening at the umbilicus from persistence of the vitelline duct.

He reports a case of a child three months old with imperforate rectum and anus, extroversion of the bladder and urachus to the umbilicus, and an opening between the ureters through which fæces escaped freely, and through which the intestines prolapsed. At post-mortem the rectum, entire colon, and mesocolon and cæcum were absent. The ileum opened into the extroversion and was continued beyond the opening as a short contracted diverticulum, like a vermiform appendix, the sole remnant of the hind gut.

Dodd[4] reports a case in which the symptoms appeared when the child was three weeks old. It died in the twelfth week, vomiting having gradually increased and the bowel movements decreased. Autopsy showed congenital contraction of the ascending and transverse colon to the size of a lead pencil. The descending colon, sigmoid, and rectum were distended but otherwise normal in appearance, with the exception of a partial annular constriction of the sigmoid.

Dr. John H. Jopson said he had seen one case of congenital stenosis of the colon which resembled to some extent that described by Doctor Brown, but in which the condition of intestinal occlusion was of even greater degree. There was a congenital atresia of the entire colon, but not of the rectum. In addition, there was a stenosis of the upper portion of the jejunum at a number of points, and a great narrowing of the lower portion of the ileum. The portion of the small intestine between these points was greatly dilated. The condition of the colon was discovered as in this case when a colostomy was attempted without avail. The condition is, of course, incompatible with life. He had recently seen a case of congenital stenosis of the sigmoid, with chronic incomplete obstruction in an infant, which when seen at the age of seven months, weighed six pounds and twelve ounces. The bowels were always constipated, and after a few weeks moved only with injections, and there was frequent vomiting after feedings. A palpable mass revealed the position of the dilated and frequently impacted colon above the pelvic brim, and the

[3] Ball, Sir Chas.: Rectum, Diseases and Developmental Defects, 1908.
[4] Dodd, A. H.: Lancet, 1892, 1, 1299.

X-ray examination showed an extreme degree of stenosis of the sigmoid. Only by the most skillful care and nursing had the child been carried along to this age, and operation was suggested, but as yet has not been agreed to. It now weighs eleven pounds, and is eleven months of age. The condition of the colon shows practically no change, and the dilatation is still confined to its lower end.

STATED MEETING, HELD NOVEMBER 1, 1920

The President, Dr. George G. Ross, in the Chair

BONE TRANSPLANT FROM CREST OF ILIUM TO MANDIBLE

Dr. Robert H. Ivy presented a man, aged twenty-seven years, who when seven years of age had a large section of the left side of the mandible removed, comprising the full thickness of the bone, for a large growth which a well-known surgeon diagnosed as sarcoma, this diagnosis being confirmed pathologically. Since that time he has worn a prosthetic appliance which partially overcame the deformity and enabled him to masticate food fairly well. Of late years, however, changes in the shape of the jaw and in position of the teeth affected the fit of the appliance, so that it was rapidly becoming useless. Examination revealed (Fig. 1) an absence of something over two inches of the left side of the mandible from the canine region to the angle. A small portion of the ascending ramus with coronoid and condyloid processes was present, this fragment being movable at the joint. The remainder of the mandible showed great instability and a marked tendency to swing over to the left side, with consequent loss of facial balance and interference with function. The success attending bone grafting in cases of ununited gunshot fracture of the mandible during the recent war led him to attempt a bone transplant in this case. Cast silver splints were made by Dr. J. E. Aiguier, fixing the right side of the mandible in proper relation with the upper jaw. On March 17, 1920, at St. Agnes' Hospital, under ether intrapharyngeal anæsthesia, an incision was made over the region of lost substance, the ends of the fragments were exposed and freshened, and a graft 2½ inches long was removed from the crest of the ilium and inserted to fill the gap, being attached to the fragments by means of silver wire. The wound was closed in two layers. Some suppuration occurred, part of the surface of the graft being exposed for several weeks, but the wound eventually closed, and the vitality of the graft was not interfered with. At the present time there is firm union at both ends of the graft, and the jaw is in good position (Fig. 2). An artificial denture will shortly be prepared. The operation left a depressed scar, adherent to the bone. On October 15, 1920, at the Medico-Chirurgical Hospital, the scar was excised, the edges were undermined for some distance, and after complete hæmostasis a strip of fascia lata from the left thigh was inserted into the pocket under the skin, being retained in place with a few catgut

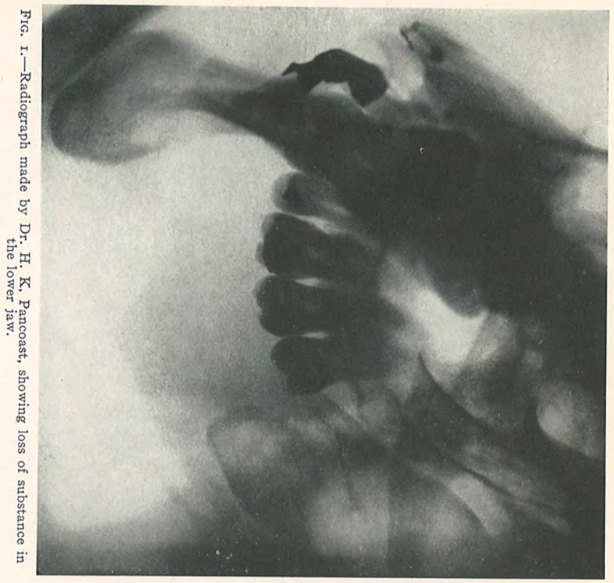


Fig. 1.—Radiograph made by Dr. H. K. Pancoast, showing loss of substance in the lower jaw.

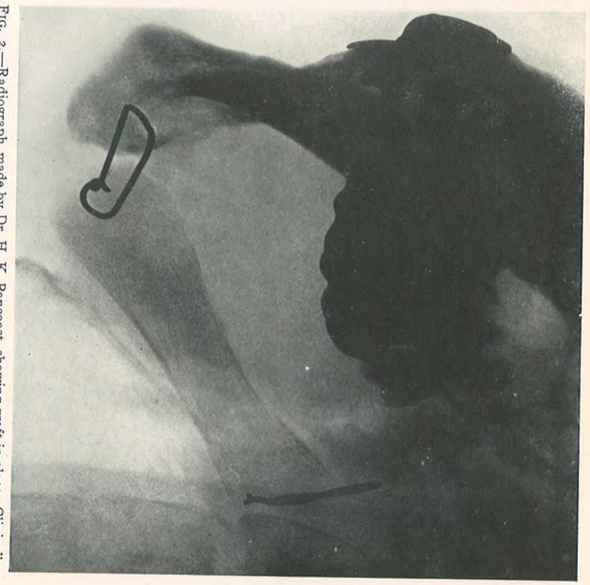


Fig. 2.—Radiograph made by Dr. H. K. Pancoast, showing graft in place. Clinically, firm union is present, although this is not altogether apparent in the radiograph as far as the anterior end of the graft is concerned.

sutures. The wound was closed with interrupted sutures of horsehair. In this manner the depression was obliterated. The wound healed without complications, the sutures were removed on the sixth day, and in ten days the patient was up and about.

Payr, of Griefswald (*Zeitschr. f. Chir.*, September 5, 1908), employed a piece of rib to replace loss of substance of the mandible. Oppel, of Petrograd, in 1910 used osteo-periosteal fragments from the clavicle. Vorschütz, of Cologne (*Deutsch. Zeitschr. für Chir.*, September, 1911), reports two cases in which a graft was taken from the crest of the tibia. In both cases the transplanted bone was extruded, but sufficient periosteum remained for regeneration to occur. Abadie, of Oran (*Bull. et mém. Soc. de Chir. de Paris*, 1912, xxxviii, 649), records the use of a free rib graft following resection of the mandible for follicular cyst. The functional and cosmetic results were good, although the bone was apparently absorbed and replaced by dense fibrous tissue.

CALCULUS IN WHARTON'S DUCT

Dr. Robert H. Ivy presented a man who for six days had complained of pain and swelling beneath the tongue on the right side of the mouth, and a swelling in the right submaxillary region of the neck, all of which symptoms gradually grew worse. The swelling in the neck partly subsided after two days, but again increased. The patient stated that he had had the same symptoms nine years before, but that they had passed away gradually without treatment. Examination revealed a small hard, tender lump just beneath the mucous membrane on the right side of the floor of the mouth opposite the second molar tooth. There was also a circumscribed, oval, rather soft, slightly tender swelling just beneath the angle of the jaw on the same side. Upward pressure on this made the lump in the mouth more prominent. At first radiographic examination was negative, but a second film placed well back horizontally between the teeth showed a large opaque body (Fig. 3) in the region of Wharton's duct. Through an incision in the floor of the mouth a large oval calculus, 2.3 by 1.9 by 1.4 cm. in size and weighing 0.9 grm., was exposed and removed (Fig. 4). A small iodoform gauze drain was placed in the wound, which healed in a few days without complications.

Erdman has recently reported (*Jour. A. M. A.*, May 22, 1920, p. 1447) five cases of calculus in salivary ducts, and states that about three hundred cases have been recorded altogether. It is probable, however, that the condition is commoner than these figures would indicate, many cases occurring without being reported. About two-thirds of the cases involve Wharton's duct, 20 per cent. Stenson's duct, while in a small number the sublingual gland is involved. The largest stone in Erdman's series was 1.3 cm. in length. The principal component of salivary calculi is calcium phosphate, other substances being calcium carbonate and organic matter.

Important points in the diagnosis are the presence of a hard, tender swelling in the floor of the mouth associated with submaxillary enlargement which varies in size from time to time, and the radiographic findings. Combined internal and external palpation is of great value. Radiographic findings are frequently negative, owing to faulty technic. A large dental film placed horizontally between the teeth, as far back in the mouth as possible, and the rays directed from beneath the chin, will usually reveal the calculus. The commonest condition causing error in diagnosis is dento-alveolar infection with enlarged submaxillary lymph-nodes.

Dr. Edward B. Hodge reported that he had had four or five cases; the youngest, a colored child nine years of age. Another case was in a nurse, who refused operation and suffered for a year and a half, when suppuration forced her to operation. Here the stone was found in the submaxillary gland, where it had been located by previous X-ray.

Dr. John B. Carnett said that eight or ten years ago he saw three cases of stone in Wharton's duct in the course of a few months. In none of them was the stone nearly as large as the one shown. Skiagraphs taken of two of them were negative. There were four stones in the three patients, and in all three patients there was a characteristic mild colic while partaking of food. The submaxillary gland on the affected side enlarged in all three during meals, and in one case pain was so severe that the patient left the table frequently before completing the meal. In all three patients simple incision over the stone allowed its easy evacuation. The incisions closed up without trouble. All the patients were young adults and none had had any further trouble a year later, and one seen during past month has had no further difficulty.

FRACTURES INVOLVING JOINTS

Dr. W. E. Lee and Dr. Walter Levering presented three fracture cases from the service of Doctor Lee, the first two treated at the Pennsylvania Hospital, and the last at the Germantown Hospital. Although the fractures are of different regions, namely, just above the elbow, the knee and the ankle, respectively, there are certain points of similarity about them which are worth considering. (1) In all there was a history of violent trauma. (2) In all there was considerable displacement of the fragments. (3) In all a joint was involved either directly or indirectly. (4) The treatment was somewhat the same, namely, by reduction under general anæsthesia, and fixation with extreme flexion. (5) The end-results in all were satisfactory.

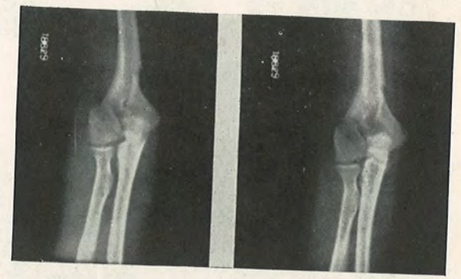
The first case, Miss J. W., aged twenty-one years, on March 11, 1920, while working at a bookbinding machine got her right arm caught and was drawn forward. The pain was so intense that she could not explain the manner in which her arm was twisted. She was brought to the hospital at once, and was dressed in the receiving ward on an anterior straight splint. Arm in extension. Receiving ward diagnosis, supra-

Fig. 3.—Large dental X-ray film placed horizontally between teeth showing calculus. Made by Dr. L. M. Ennis.

Fig. 4.—Calculus.

Fig. 5.

Fig. 6.



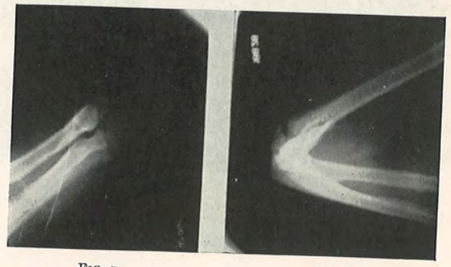


Fig. 7.

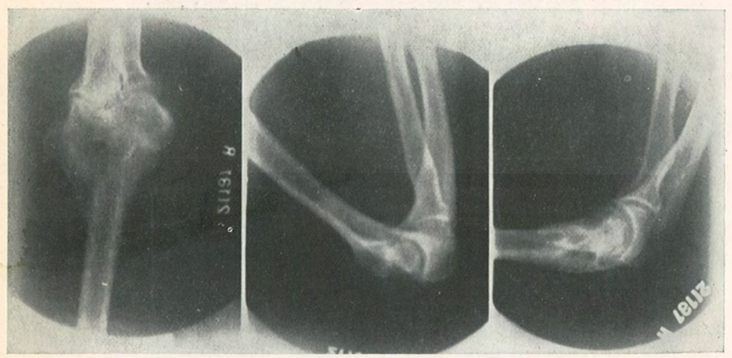
Fig. 8.

Figs. 5, 6, 7, 8.—Supracondylar fracture of humerus extending into elbow joint.

FIG. 9.

FIG. 10.

FIGS. 9, 10.—Ankylosis imminent.



FIGS. 11, 12.—Range of motion on completion of treatment in case shown in Figs. 5 and 6.

FIG. 13.

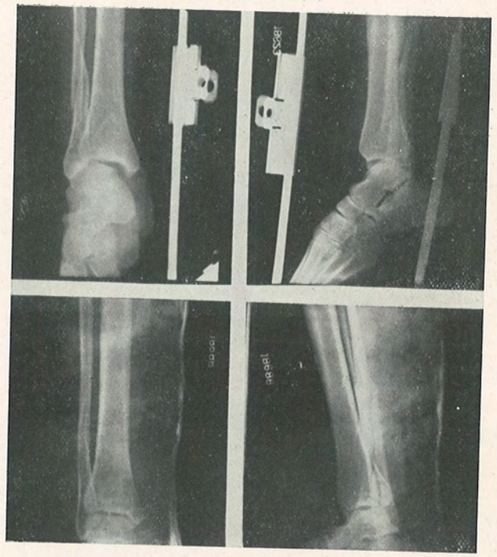


FIG. 14.

FIG. 13.—Fracture of fibula and tibia involving ankle joint.
FIG. 14.—Result after operative correction of deformity.

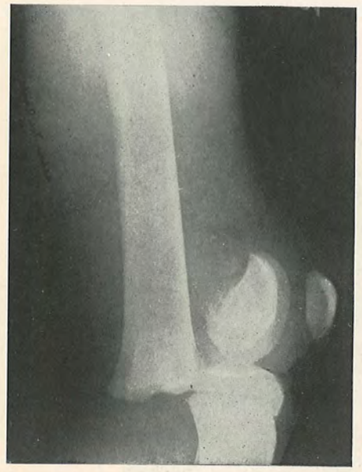


FIG. 15.—Separation of the lower epiphysis of femur.

FIG. 16.—Separated epiphysis restored to place by acute flexion of knee.

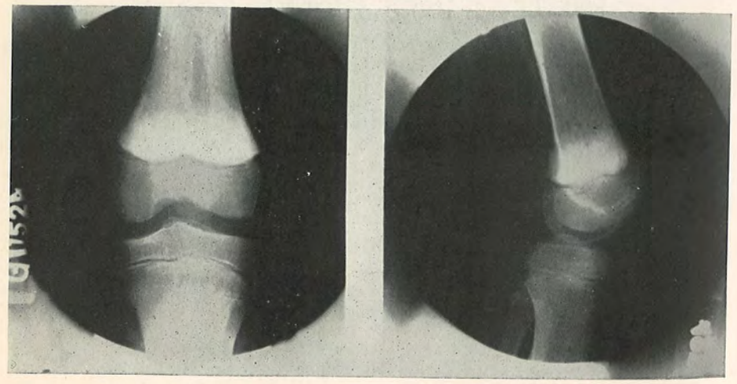


FIG. 17.—Ultimate result from treatment of case shown in Figs. 15 and 16.

condylar fracture of humerus. She returned the following day, was X-rayed and admitted to the ward. The X-ray (Figs. 5 and 6) showed a supracondylar fracture of the humerus comminuted, of the T-shape variety, involving the trochlear surface of the joint. There was complete displacement, the lower fragments being anterior. At the end of a week she was discharged from the hospital and sent to the dispensary. Here it was found that the deformity had not been corrected and she was returned to the hospital. On March 25th, fourteen days from the time of the injury, under ether anæsthesia, Doctor Lee reduced the deformity and dressed the arm in Jones position. X-ray examination (Figs. 7 and 8) then showed excellent position of the fragments. Patient was then treated in the dispensary. X-ray examination on May 14th showed some absorption of the articular cartilages, and the röntgenologist suggested that ankylosis was imminent (Figs. 9 and 10). Massage and active and passive motion was kept up, and a final X-ray taken October 30th shows what appears to be a perfect joint (Figs. 11 and 12). The patient has complete flexion, 170 degrees extension, and complete pronation and supination. She has returned to her original work and her earning power has not been reduced.

The second case, Mrs. E. B., aged thirty-one years, on March 6th was thrown from an automobile, landed on her feet and turned her ankle under her. She was brought to the hospital immediately, a diagnosis of Pott's fracture made, dressed in a Thomas splint, with a stocking extension. X-ray (Fig. 13) examination showed comminuted fracture of the right fibula, a short distance above the malleolus. There was also a fracture of the tibia, at the tibiofibular articulation. There was marked backward displacement of the foot and distal fragment of the fibula. On March 12th, six days after the injury, under nitrous oxide anæsthesia, tenotomy of the tendon of Achilles was done, the deformity reduced, and the foot put in a plaster case in extreme flexion and internal rotation. X-ray examination (Fig. 14) showed excellent position of the fragments. The end-results at time of reporting this case show complete function and no deformity about the ankle.

The third case, a boy, A. Mc., aged eleven years, on July 18, 1920, fell from a hay loft a distance of about eleven feet. His left leg went into a post hole, and he was thrown forward. He was brought to the hospital at once. Examination showed swelling and crepitus just above the left knee. The leg in hyperextension. X-ray examination showed an epiphysial fracture of the femur and complete backward displacement of the upper fragment (Fig. 15); under ether anæsthesia the deformity was reduced and the knee dressed in acute flexion (Fig. 16). Patient was left in this position until the thirty-fifth day, when it was found he had contraction of the hamstring tendons and could not extend the leg. He was again anæsthetized and the adhesions broken up, the leg being dressed on a posterior splint and considerable pressure put on the knee

to promote extension. After three weeks of this it was found the boy had a toe-drop, due probably to pressure of bandage on a nerve. He was discharged from the hospital in September and sent to the dispensary. At the time of his discharge X-ray (Fig. 17) shows good union and excellent position of the fragments. Function of the knee was complete; he still, however, has slight toe-drop. This is undergoing rapid improvement.

Dr. A. Bruce Gill said that orthopædic surgeons are frequently called upon to examine or treat cases of fractures in the neighborhood of joints, because the patients present a disability of the extremity which persists oftentimes many months after the fracture. This is particularly true of fractures at the wrist and the elbow. If a fracture at the wrist is succeeded by swelling of the hand and fingers which persists, not infrequently a condition of fibrous ankylosis of the joints of the fingers, particularly of the metacarpophalangeal joints, results. This ankylosis is due particularly to the swelling; that is, to the interference with circulation. The disability which results from a Colles fracture is nearly always due to the ankylosis of the fingers rather than to any interference with the function of the wrist joint. If the fracture is properly reduced and proper dressing is applied, either the swelling does not occur, or if it has occurred, it subsides quickly after complete reduction is accomplished. If the swelling persists after a week or longer it should be considered as an indication that the fracture has not been reduced.

The surgeon cannot rely entirely on the X-ray examination. Sometimes the X-ray shows fairly good reduction of the fracture, but the swelling persists. At other times there is fairly marked displacement of the fracture, but there is no swelling of the hand, and the patient has no loss of function as a result of the fracture. The persistence of swelling should be a chief guide in the treatment of the fracture.

In a similar manner, fracture of the lower end of the humerus may lead to long-continued disability or even permanent disability of the hand because of ischæmic paralysis, or Volkmann's contracture; or because of ankylosis of the fingers which has been caused by the persistent swelling of the hand. A proper reduction of the fracture before the first dressing will eliminate any danger of such untoward results. To dress the elbow in acute flexion without complete reduction of the fragments tends to produce a constriction of the vessels at the elbow, which may cause a Volkmann's contracture, or fibrous ankylosis of the joints of the hand.

He had seen cases of fracture of the upper end of the humerus or dislocations of the shoulder produce a long-continued disability of the hand which was due to this same fibrous ankylosis of the joints of the fingers. In practically all of these cases can be obtained a history that the hand remained swollen for a period of weeks during the treatment of the fracture or dislocation. One cannot emphasize too strongly the necessity of watching carefully for circulatory disturbances, for such disturbances usually indicate an incomplete reduction of the fracture, or, less commonly, an improper dressing.

PAPILLARY CYSTADENOMA OF THE BREAST

Dr. John H. Gibbon reported two cases of papillary cystadenoma of the breast and exhibited the specimens. Both cases had been operated upon within a week. The first was that of a woman, sixty-five years of age, operated upon at the Jefferson Hospital, October 26, 1920. She had had ten children and two miscarriages. Mass in the breast first noticed ten years ago. Other masses developed and about two years ago one of them was incised by her physician and a quantity of blood and pus evacuated. The breast contained several masses, the largest about the size of an egg, covered by thin skin and evidently containing dark fluid. Translucency was present in the largest mass. The swellings were grouped around the centre of the breast, the nipple was contracted and considerable fibrous tissue could be felt between the tumors. The breast was freely movable but an enlarged gland could be palpated in the axilla. Through a Stewart incision the breast with the great pectoral muscle and all the axillary glands and fat was removed. The glandular involvement was much more extensive than he had expected. On opening one of the cysts it was found to be filled with bloody fluid and at one point there was marked papillary outgrowth. A part of the cyst wall was calcareous. Microscopic diagnosis in this case was "papillary cystic adenocarcinoma of mamma with metastasis to the axillary lymph-nodes."

The second case was that of a woman forty years of age, operated upon at the Pennsylvania Hospital, October 27, 1920. This patient had never been pregnant. Had noticed a tumor in the left breast for six or seven years. It remained quiescent until about six months ago, since when it has progressively increased in size. Examination showed a multilocular, freely movable, fluctuating tumor in the outer and lower quadrant of the left breast. No glandular enlargement was detected. Through a Stewart incision the breast, with the sheath of the pectoral muscle and the axillary glands and fat, was removed. On opening one of the cysts, which presented on the posterior surface of the gland, it was found to be filled with a papillary outgrowth. Thinking that the condition was probably malignant, the great pectoral muscle was then removed and a more complete dissection of the axillary glands and fat made. The microscopic diagnosis in this case was "papillary intracystic fibro-adenoma." The lymph-glands in this case showed no evidence of metastasis.

The incidence of papillary cystadenoma of the far-advanced type represented in the cases shown is rather rare nowadays, because all cases of tumor of the breast are receiving much earlier treatment. The condition has been described by many writers under many names. It is the hydatid disease of Sir Astley Cooper, the serocystic sarcoma of

Brodie, the cystosarcoma phylloides of Müller, and the proliferous cyst of Paget. Paget's description of the condition in his "Lectures on Pathology," 1853, is a most complete one, and he describes the clinical course of the disease in a very thorough manner.

During the past ten years the reporter had operated upon six cases of papillary cystadenoma and twenty-eight of fibrocystadenoma, which shows that the condition is not very rare. Of course, during this same period the cases of subinvolution-cysts of the breasts have been much more numerous than the two other types combined.

The classification of these cases has always been confusing because of the association of the fibrous and epithelial elements in the tumors. Collins Warren, however, in his "Surgical Oration" before the A. M. A., in Portland, 1905, clarified the difficulty by proposing the two terms, fibrocystadenoma and papillary cystadenoma. He reported twelve cases of the latter condition from the Massachusetts General Hospital and his own practice.

This disease is seen in women usually past forty-five and who have borne a great many children. The tumors grow slowly for years and are then apt to take on rapid growth. Rupture by ulceration took place quite frequently in the cases reported fifty years ago, and the growth taking on a fungoid character was considered sarcoma.

The skin in the later stages becomes thin, the cysts stand up prominently and are often translucent, as in one of the cases here reported. The tumors usually form about the nipple and much fibrous tissue can be felt between them. Fluctuation is distinct. Glandular involvement is rare. Paget reports a case in which there was glandular metastasis and recurrence, and in one of the speaker's own cases malignant glandular involvement was present. Bleeding from the nipple is considered one of the common symptoms, but it was present in neither of the cases, specimens of which he was exhibiting.

Clinically the condition must be looked upon as malignant, although in its early stages it is only mildly so. The differentiation from fibrocystadenoma, or what is commonly called cystic adenoma, can be made by macroscopic inspection of the cyst wall, which in the one case is smooth and in the other contains papillary outgrowth.

The treatment of this condition, of course, is amputation of the breast together with the removal of the axillary glands and fat, as it is impossible to tell whether or not an epitheliomatous change has occurred. He did not think that the absence of palpable glands in these cases is sufficient to justify one in omitting the dissection of the axilla.

RATIONAL TREATMENT OF FRACTURES OF THE TUBULAR BONES

Dr. John B. Roberts said that a gratifying sequel of the European war has been to dispel the delusion that a great group of closed fractures of the long bones must be subjected to adjustment of fragments by blood-spilling operations; as a consequence, the ability to obtain good results in such fractures, without resort to incisions for inspecting and fixing fragments, has been secured by many medical men. Thus the former craze for operative reduction has been much lessened. The treatment of open, contaminated and infected fractures, moreover, has been greatly improved by the investigation and experience of military surgeons. A rational study by the inductive method seems to him to establish these propositions:

The majority of closed fractures of long bones may be cured with good function and good anatomical result without exposing the bone by operation. Some open fractures of these bones, if kept aseptic, may be properly cured without exposing the bone by operation.

A moderate proportion of closed fractures only will need operative exposure of bone, to correct malposition of fragments; and some of these should have direct fixation.

Many open fractures, especially gunshot injuries, will require operation to convert contaminated fractures into aseptic fractures, and to permit primary closure of the wounds. Some of these open fractures will also need readjustment of fragments and possibly direct fixation of fragments.

Conversion of contaminated fractures into aseptic fractures should be done within the first eight or ten hours by removal of foreign bodies, excision of debatable soft parts and perhaps of the small fragments; whenever practicable, the wound then should be closed by primary suture and the bones given external rigid support.

Closed fractures needing exposure of bone for readjustment of fragments probably do better, in respect of freedom from sepsis, if operated upon about seven days after injury.

Comminution of bone in closed fractures does not add much to the severity of the injury, but it requires that the external support and the accuracy of coaptation receive vigilant attention.

Comminuted open fractures, if kept aseptic or early rendered aseptic, do well, because the small fragments may furnish many centres of callus deposition.

Nearly all closed fractures and many open ones of the upper limb may be successfully treated as to functional ability and anatomical integrity by means of ambulatory dressings.

Nearly all fractures of the lower extremity, whether open or closed, do better when treated in bed with suspension of the limb and more or less continuous traction. An exception to the rule of treating fractures of the lower limb in bed may be made in fractures of the fibula and of bones of the foot.

Most fractures of the femur, and a considerable number of the tibia, must have strong traction added to suspension of the external fixation apparatus.

A few fractures of the upper limb, closed and open, require suspension with traction. This is particularly true in fractures of the upper end of the humerus, and is more frequently needed for infected fractures in this site.

Fixation by external splinting is best given to the upper limb by using the thorax as a splint for the humerus; some form of plastic material moulded to the surface is usually best for the bones of the forearm. Encircling the arm or forearm is dangerous in the early stages of the treatment; it is liable to cause ischæmic myositis or gangrene.

When suspension and traction are required for upper limb fractures the patient should be kept in bed for a time; and external splinting should usually be obtained by steel rods used in similar form to the braces and splints advised in fractures of the lower limb or by a modified Buck's traction apparatus.

The suspension and traction so valuable in fractures of the femur may best be obtained by the N. R. Smith or Hodgen anterior heavy wire splint, the modified Thomas splint, or by traction with the Buck's extension method, with or without suspension, or by adoption of the Bradford frame. The Thomas splint is probably the best of these methods in adults with great overriding of the fragments. It is particularly valuable if the patient must be subjected to transportation.

The joints, muscles and skin in fracture cases should be given attention from beginning to end of treatment, if the best results are to be obtained.

Joints should not be kept immobile longer than one or two days. Careful passive and active movements usually should be allowed within the first few days, and frequently repeated during the course of the treatment.

It is a common practice to permit weight bearing on fractures of the lower extremity too soon. Secondary deformity is frequently caused by this error. Crutches and braces and other devices should be used to prevent such deformities.

No special form of splint or apparatus can be substituted with safety for that knowledge of anatomy, pathology and mechanical intelligence which constitutes a surgical grasp of the particular fracture needing professional care.

Dr. John H. Gibbon remarked upon the change that has taken place in the last five years regarding the treatment of fractures. A question of the utmost importance mentioned by Doctor Roberts is that of mobilization. Movement, both passive and active, is that which is most needed to-day in the treatment of fractures in civil life. In fractures of the thigh he had taken out more plates than he had put on. He recently saw the case of a boy operated on eight years ago for fracture of the thigh; it was plated with a good result. The boy suffered a refracture three weeks ago at the site of the last screw. Traction to overcome the deformity was unsuccessful. There was nothing to do but to operate, and he found a lot of blood serum, with pus, around the plate. There was no fever. He took away the plate, but could get only partial reduction. The wound was closed without drainage. This was three weeks ago. There is a good deal of union at this time.

STATED MEETING, HELD DECEMBER 8, 1920

Dr. William A. Downes in the Chair

PERICARDIOTOMY FOR SUPPURATIVE PERICARDITIS

Dr. Eugene H. Pool presented a man whose history is related in a paper read by him, entitled "Pericardiotomy for Suppurative Pericarditis," for which see page 174.

Dr. Howard Lilienthal presented a man upon whom he had operated twenty-one years ago for suppurative pericarditis following pneumonia. At operation the pericardium was found very much thickened. The operation was performed in very much the same way as described by Doctor Pool, with the exception that a tube was not used except to wash out the pericardium. The details of the case were published in the *Medical and Surgical Reports of Mount Sinai Hospital*, 1899. According to the man's statements, he is now perfectly well, and Doctor Lilienthal said that though he had not had the opportunity of making an examination recently the man was apparently in perfect health.

Dr. Robert Grier LeConte, of Philadelphia, said the points which Doctor Pool had emphasized seemed to be the correct surgical ones to bring out. But it must not be forgotten that in post-mortem statistics of pneumonia and other grave diseases, suppurative pericarditis might be present when the symptoms in life were masked or not sufficiently prominent to permit of diagnosis. In the second place, it might not have been the cause of death, but only a participant in final dissolution, so practitioners should not be blamed for bringing few patients with pericarditis to the surgeon. Some years ago, Doctor LeConte said, he had been interested in studying the relation of the pleuræ and the pericardium on the right and left sides, and the studies he had then made were illustrated in the pictures which Doctor Pool had shown. The only way of attacking a suppurative pericarditis was to always drain the dependent portion of the sac. Doctor LeConte stated that the first case he resected in which he performed pericardiotomy was in 1900. In that case he resected the fourth and fifth costal cartilages and dissected up the triangularis sterni, which gave a free exposure without wounding the pleura. One could sometimes see the fold of pleura covering the pericardium, but often it was obliterated by the inflammation, so one could not count upon finding it. The position of the heart within the pericardium would depend upon adhesions taking place prior to the distention of the sac with

pus, and therefore before making a puncture the heart should be located with the fluoroscope to prevent injury with the needle. Puncture should be made as near the sternum as possible, in the fifth or sixth interspace, to guard against traversing the pleura. For diagnostic purposes withdrawal of some of the fluid was as necessary as in empyema. When the pericardium was opened no annoyance was caused to the great vessels by gently manipulating the heart and freeing it from adhesions. This freeing of adhesions with draining of the posterior area would probably prevent pocketing or loculation later.

Doctor LeConte said he had never used Dakin's solution in the pericardium, but he believed it was just as applicable to the pericardium as to the pleura, and he saw no reason why we should have a different procedure in the one than we did in the other.

Dr. George P. Muller, of Philadelphia, said that he was in particular agreement with Doctor Pool as regarding the necessity for drainage of the dependent part of the pericardium. The method of exposure advocated by Doctor Pool was very satisfactory. He did not think that suppurative pericarditis was particularly common except in association with certain forms of empyema. He had seen five cases only and one was operated upon. Two others were not recognized until too late, and in one case timidity on the part of the physician in charge prevented drainage.

With regard to the recess behind the left auricle, considerable space was given to this pouch by Ballance in his recent book on the surgery of the heart. Doctor Muller also had noted that in Doctor Pool's earlier paper much was made of a case in which at autopsy an undrained abscess was found in the heart sac and behind the left auricle. According to Ballance, even dependent drainage would not reach this recess, and he advocated antero-lateral drainage, but it was difficult to see how such could be accomplished without seriously threatening the integrity of the pleural cavity.

Doctor Muller offered the following case for the record: A boy sixteen years of age, with a previous history of diphtheria and rheumatism and frequent attacks of tonsillitis two years previously. He was well until two weeks before admission (May 31, 1915) to the University Hospital, at which time he complained of dyspnœa, palpitation and swelling of the ankles. There was a dull pain over the liver and heart, and cough. The pain was worse on inspiration. The boy thought the symptoms came on shortly after lifting a heavy weight. Physical examination of the chest revealed cardiac dulness as beginning at the second rib and extending to the upper border of the sixth, being greatly widened to right and left. The apex beat was noted in the fourth interspace within two cm. of the limit of dulness. There was a blowing systolic murmur at the apex, but no arhthymia. In the third interspace there was a to-and-fro friction rub. The blood count showed 16,000 (71 per cent. polymorphonuclears) leucocytes. X-ray examination revealed the presence of a large pericardial effusion.

Operation was performed in the University Hospital, June 5, 1915. Intratracheal ether anæsthesia was employed. An oblique incision three inches long was made to the left of the sternum over the sixth rib. One inch of the cartilage of this rib was removed. The muscles were pushed aside and the pericardium grasped, opened and its cavity explored. Several ounces of the bloody serum were evacuated and the heart found lightly adherent to the pericardium. About six more ounces were evacuated after separating these adhesions. Arythmia and extra systoles were noted when the heart was touched. A rubber tube was sutured into the pericardium projecting inwards about one inch and the wound closed around it. The recovery was uneventful, and nine days later the tube was removed and not replaced. The fluid evacuated was found to contain many pus-cells and blood-cells; it was examined bacteriologically, but unfortunately this was not attached to the record.

Dr. Willy Meyer reported a case of chronic inflammation, a sero-sanguino-fibrinous pericardial effusion, in a tuberculous patient, thirty-three years of age. This patient was operated upon at the Lenox Hill Hospital in 1908. The left pleural cavity had been repeatedly aspirated and large quantities of clear serous fluid evacuated. The X-ray examination showed an enlargement of the pericardium and aspiration was performed by him. The puncture was made in the fifth intercostal space, close to the sternum, and 1200 c.c. of a dark fluid evacuated. The patient improved at once, but in one week a second aspiration was required, and 1000 c.c. withdrawn. After six days incision and drainage were absolutely indicated. In doing the operation the same method mentioned by Doctor Pool and Doctor Lilienthal was employed. Under local anæsthesia the sixth and seventh costal cartilages were resected and the internal mammary vessels tied and cut to get the proper access. The pleural cavity was first tapped and then the parts were pulled aside and an incision made into the pericardium. More than two quarts of fluid were evacuated. A drop-light was then used to inspect the pericardium, and the finger introduced to feel the heart beat. No pulsations could be made out. Then with stick sponges large quantities of fibrinous material were removed. The fingers now again introduced into the pericardium could feel the heart pulsations. Often in these cases of chronic effusion very large amounts of fluid were present (quarts) which was easy to understand, as the mediastinum could expand bilaterally as well as posteriorly. The first thing to be carried out in these patients after the usual clinical examination was an X-ray examination; then the aspirating needle should be used. Repeated aspiration was contra-indicated; free incision of the pericardium with thorough drainage should always be made, and fibrinous coagulations, as found in chronic effusions, thoroughly cleared out.

Doctor Meyer stated that he had seen this patient one year after the pericardiotomy was performed and he was then in very good condition. He was presented with the wound healed before the Surgical Society in 1909.

Dr. William Darrach reported a case of suppurative pericarditis occurring in a very sick negro. Drainage was instituted under local anæsthesia with considerable difficulty. The man returned later with pericardial adhesions and general anasarca, and died.

Dr. John H. Jopson, of Philadelphia, spoke of the use of the Carrel-Dakin method in the pericardium. He had operated on a young man last spring, who had what proved to be a general staphylococcus infection, beginning in the accessory sinuses. Admitted to the Presbyterian Hospital when very ill, a laryngologist operated upon him for this, and later Doctor Jopson was called to see the patient for a suspected pleural involvement. After two weeks an empyema developed on the right side, also of staphylococcic origin. This was drained under local anæsthesia. Soon after the boy began to suffer from cardiac embarrassment, and the X-ray showed a large pericardial effusion. At operation under local anæsthesia a single costal cartilage, the fifth, was resected. Doctor Jopson said he then began to use the Carrel-Dakin treatment with some trepidation. The empyema on the right side was simultaneously Dakinized. The left pleura was aspirated several times for a reaccumulating collection which remained serous. The Dakin solution was badly borne in the pericardium, and caused cardiac embarrassment, the fluid apparently being too thick and gelatinous after mixing with the pus, and it had to be given up. The patient made a strong fight for life, and finally died after an illness of more than eight weeks. An antistaphylococcic serum was also used. Doctor Jopson expressed the opinion that the method of drainage described by Doctor Pool was a most valuable one, superior to any hitherto described, and would certainly replace the old method of single cartilage resection which gave poor drainage, while this was ideal. The Carrel treatment failed in his case because of the absence of dependent drainage which was advisable here.

GASTROENTEROSTOMY IN PERFORATING ULCER OF THE STOMACH

Dr. John B. Deaver, of Philadelphia, read a paper with the above title, for which see page 189.

GASTROENTEROSTOMY IN PERFORATING ULCER OF THE STOMACH CURVATURE

Dr. John F. Erdmann presented a man, fifty-three years of age, who one year ago began to suffer from abdominal distress four to five hours after eating. Later he began to vomit. The vomiting had existed for the major portion of the past year and consisted of mucus to food taken the day before. There had been a slight loss in weight—five to seven pounds. He had never had any severe pains, never been bedridden, and never been conscious of losing blood, either by mouth or rectum.

November 6, 1920, he was operated upon for ulcer of the duodenum. Upon exposure it was found that profound adhesions existed between the gall-bladder and duodenum with calculi in the gall-bladder and a fistula

between an old perforated duodenal ulcer and the gall-bladder. In addition, an ulcer of the size of a twenty-five-cent piece was disclosed upon the lesser curvature and posterior wall of the antrum. The appendix was atrophied. A cholecystectomy was done, in addition to closing the duodenal ulcer opening, and a typical Balfour excision of the gastric ulcer. The appendix was not disturbed.

DUODENAL FISTULA FOLLOWING CHOLECYSTECTOMY, WITH FOREIGN BODY

Doctor Erdmann presented a woman, thirty-nine years of age, who was seen by him October 14, 1920. She gave a history of having been operated upon for gall-stones and appendix in New York City on May 26, 1920; again on June 1st, ostensibly for adhesions, with pus and bile leakage, accompanied with chills and fever; again on August 19, 1920, for a pus pocket. On the day Doctor Erdmann saw her she presented a fistula in the right upper quadrant, but no apparent bile. She stated that she had at one time discharged what looked like coagulated milk. There had been no chills since the third operation. She had lost forty pounds in weight. She said that her operating physician had to pack her wound during the second operation because of bleeding. She had required two dressings a day to keep her comfortable. A diagnosis was made of intestinal fistula, or foreign body.

A few hours before operating upon her Doctor Erdmann was called by telephone and advised by another physician that he had assisted at the third operation and removed quite a piece of gauze. Operation, on October 19, 1920, revealed dense adhesions. The sinus enlarged as deep approach was made. No gall-bladder was present. A foreign body, a piece of gauze, rolled like a cigar, four inches long, and one-half inch in diameter, and foul smelling, was found. Removal of this revealed a hole, with indurated and irregular edges and large enough to admit a silver quarter, in the upper surface of the first portion of the duodenum.

Suture of the opening was made in three tiers, and a gastroenterostomy was done. The patient was discharged from the hospital in twenty-nine days, with only a small spot of granulation at the site of the original drain.

ABDOMINAL SINUS; SUBPHRENIC ABSCESS; CHOLECYSTO-DUODENAL FISTULA

Doctor Erdmann presented a woman, fifty-one years of age, who was first seen by him September 22, 1920. One year before, in Nebraska, she had been operated upon for gall-stones, remaining three months in the hospital. She left the hospital with a persisting fistula. In November, 1919, she went to Rochester, Minnesota, and while under observation there her fistula closed. She was told by one of the physicians to return in a year to have her gall-bladder removed. Two months before seeing Doctor Erdmann she began to have pain in the operated region, and in a few days the old sinus reopened and discharged pus and blood. She had lost considerable weight and

presented the appearance of secondary anæmia, characteristic of malignancy. There was a most foul, brownish, free discharge from the sinus, which she stated required from two to five dressings a day. No bile color observable.

While under observation in the Post-Graduate Hospital she ran a temperature of from 99½° to 103° per rectum. She was anæmic, with a blood count of 3,500,000 red-cells; hæmoglobin, 47; no marked differential.

Operation (October 1, 1920) revealed an atrophied gall-bladder well below the liver border, densely attached to the colon, with a perforation into the duodenum, and a large subphrenic abscess holding over two pints of gray to brown pus, most foul smelling. The gall-bladder, upon removal and section, showed the half of a large white grape in it. The duodenal connection was closed. The subphrenic abscess was drained into the mid-axillary line and through the abdominal wound. The patient was discharged from the hospital in five weeks with a small sinus in the right axillary line.

PERFORATED GASTRIC AND DUODENAL ULCER

Dr. Charles H. Peck presented two cases, illustrating operative results in cases of perforated gastric and duodenal ulcer. The first case was that of a man upon whom Doctor Peck had operated for perforated duodenal ulcer in 1904. The operation was performed four hours after the acute onset of symptoms and consisted in a suture of the ulcer without gastro-enterostomy. The man made a good recovery. He was followed up for a number of years, during which time he was in good health; he was then lost sight of until February, 1919, when he presented himself, complaining of a recurrence of ulcer symptoms, from which he had been free for a period of thirteen years after simple closure without gastroenterostomy. He now presented evidence of duodenal stricture as shown by the X-ray and corroborated by physical signs. A posterior gastroenterostomy was performed in February, 1919, almost two years ago. Doctor Peck said he presented this patient to illustrate the end-result in operation for ulcer in the first place, and in the second place, because of the long interval that might exist before the development of a stricture which required further treatment. There was nothing special in the detail of the case, it being a typical case of ulcer at the time of onset.

The second case also had an interesting and prolonged history. This patient Doctor Peck operated upon in 1907, thirteen years ago, for an acute perforation on the anterior wall of the stomach. The perforation was at the middle of the anterior wall; closure was effected by a simple suture without gastroenterostomy. Following this operation the patient went along in fairly good health until 1911, when she presented herself complaining of indigestion and gastric pain and distress. The X-ray examination showed a typical hour-glass stomach, for which an anterior gastrogastrostomy, giving nearly four fingers' opening, was performed in January, 1911. The patient made a good recovery and was relieved of her symptoms for a few months. In September, 1911, she was operated upon for an acute gangrenous appendix which had perforated with the formation of a retrocæcal abscess. At both previous

operations she had been so seriously ill that they had not thought it advisable to prolong the operation by performing an appendectomy. In 1915 she complained of some chronic indigestion and returned to the hospital, where an X-ray exmination was made which showed the gastrogastrostomy functioning well with a broad opening which had not contracted much in the meantime. She suffered a certain amount of gastric distress in 1916, but this passed on without further operative treatment, and she was now comfortable and in good health.

Dr. Astley P. C. Ashhurst, of Philadelphia, said he agreed with Doctor Deaver in practically everything he had said, but he regretted that he had not told how many patients died without operation, for those deaths should be added to the mortality statistics. It was not so much the mortality from operation as the number of deaths from the disease that should concern us. He thoroughly agreed that it was proper to do a primary gastroenterostomy in perforated ulcer if the patient's condition permitted.

Dr. Clarence A. McWilliams said that he had looked over the records of the Presbyterian Hospital for the past four years and found that there had been a total of twenty-one patients admitted with perforated gastric and duodenal ulcers, four of whom died after operations, or 18 per cent. Nine of this total had immediate, primary gastroenterostomies performed with two deaths, or 22 per cent., while twelve had not had gastroenterostomies, of whom two died, or 17 per cent.

It was unquestioned that those upon whom gastroenterostomies were performed were picked as the best risks, consequently the mortality was sure to be greater in those upon whom a gastroenterostomy was indiscriminately performed than those without. The after-results are interesting. There were twelve cases which had no gastroenterostomy at the primary operation, two of whom died, leaving ten to be followed; of these ten, two were cured, or 20 per cent.; two were improved, or 20 per cent.; while six were unimproved, or 60 per cent.; three of these unimproved six had subsequent gastroenterostomies without mortality and one had a subsequent perforation with death resulting after operation. Consequently, it could be said that the after-results were not brilliant among those upon whom no gastroenterostomy was done. Of the nine cases with primary gastroenterostomy, the after-results were too few to be illuminating. Of these nine with primary gastroenterostomy, two died as a result of the primary operation, leaving seven to be followed; of these seven, three were cured, or 42 per cent., while four could not be followed.

From these small statistics, the position of Doctor Deaver, as to the poor after-results, seemed to be confirmed. It certainly might be wise for the expert to add a gastroenterostomy, provided the operator thinks the life of the patient would not be jeopardized. The casual operator, however, had better not yield to the temptation to do a gastroenterostomy. It would seem to be a mistake to lay down the dictum that every perforation of a stomach or duodenal ulcer must have a gastroenterostomy at the primary operation,

for this would be followed by an unnecessarily higher mortality. Stenosis of the pylorus caused by the infolding of the perforation is usually regarded as an indication, for a gastroenterostomy, yet even this is not an absolute indication, for nature overcomes a considerable constriction of the pylorus. This is shown by the large number of statistics collected from many sources by Doctor Eliot, in which it was proved that in only one or two instances among the entire series was a gastroenterostomy necessary within a few weeks of the primary operation performed for acute perforation. Whether the slightly increased mortality attendant upon a primary gastroenterostomy would be offset by the mortality following the secondary operations required in a certain proportion of cases to effect a cure, a large number of cases alone would tell. So far as perforations of gastric ulcers alone were concerned, a secondary operation would allow a procedure to be performed which would be more certain to cure than a gastroenterostomy, namely, pylorectomy, if the ulcer were near the pylorus.

PERFORATED ULCERS

Total, 21 cases, 4 deaths, or 18 per cent.

1. Without gastroenterostomy—12, 2 died, or 17 per cent.
2. With gastroenterostomy—9, 2 died, or 22 per cent.

A. Gastric, 11, with 1 death, 9 per cent.
- With gastroenterostomy, 5; 1 death.
- Without gastroenterostomy, 6; 0 deaths.

B. Duodenal, 10, with 3 deaths, 30 per cent.
- With gastroenterostomy, 4; 1 death.
- Without gastroenterostomy, 6; 2 deaths.

AFTER-RESULTS

With primary gastroenterostomy, 9 cases.
- 2 died.
- 3 cured.
- 3 could not be followed.
- 1 too early to be followed.

Without primary gastroenterostomy, 12 cases.
- 2 died.
- 2 cured.
- 2 improved.
- 6 unimproved, 3 of whom had subsequent gastroenterostomies, while 1 had a subsequent perforation, with death after operation.

Dr. Ellsworth Eliot, Jr., said that, if Doctor Deaver referred to a paper he had written some years ago, he erred in his statement that seventy-five instances of secondary operation after a primary suture of a gastric or

duodenal ulcer were cited. The number of these cases was much smaller; in fact, their percentage was not as large as in those cases collected in which there was trouble after a gastroenterostomy without perforation. Some of these latter patients had so much trouble that the gastroenterostomy had to be revised and some other operative measure applied for the relief of the ulcer. Doctor Eliot said he would agree that in perforated ulcer primary gastroenterostomy done by Doctor Deaver's skilful hands, or by hands equally skilful, would not add to the mortality of the operation, but it was perhaps unwise to induce the surgeon of less dexterity to prolong the operation in this way, for under certain circumstances it might easily jeopardize the life of the patient. In a questionnaire, in connection with the paper referred to, sent out to a number of surgeons, chiefly members of the American Surgical Association, asking their opinion in reference to the performance of primary gastroenterostomy in cases of perforated ulcer, a number answered that they were convinced that the prolongation of the operation necessary for the addition of gastroenterostomy resulted in additional fatalities. The consensus of opinion seemed to be that it was safer to limit the operation to closure of the perforation, and, subsequently, if necessary, to do a secondary gastroenterostomy. Usually a secondary operation was not required, or if required it might be, as in Doctor Peck's case, many years after the closure of the perforation. A secondary operation could be done with much less risk, particularly in relatively unexperienced hands. In recent perforations without extensive peritonitis, and in skilled hands, a primary gastroenterostomy was frequently justified, but in delayed cases coming to the surgeon twenty-four to forty-eight hours or later after the perforation with extensive peritonitis, the patient's chances of recovery are better if the perforation is merely closed. If the patient recovers and the gastric symptoms persist, a secondary gastroenterostomy can then be performed. It is interesting and important to note that the secondary operation is rarely necessary, if at all, before the expiration of several months, and frequently much later. Doctor Eliot said so far as he knew it had never been performed before the tenth day. In other words, the gastroenterostomy is done, if indicated, after the patient has fully recovered from the effect of the primary operation.

Dr. John F. Connors agreed with Doctor Deaver in all the things he said, but took exception to the performance of a gastroenterostomy in perforated ulcer as a routine measure. He cited the following statistics from a paper he had published in 1916 in which he presented an analysis of forty-two cases of perforated ulcer. Since that time there had been twelve additional cases. Of these cases 72 per cent. were simple closure by suture. In these cases 70 per cent. recovered and 30 per cent. died; in 28 per cent. of the cases a gastroenterostomy was performed at operation; 33⅓ per cent. recovered and 66⅔ per cent. died. In many of the cases which were done by suture he felt that in a large number he had lessened to a great extent the calibre of the pylorus, and it appeared at the time of operation that little if

anything could pass through, but in only two of them was it necessary to perform a gastroenterostomy at a later date; one after six weeks and the other three months.

Doctor Connors said he had seen two of the cases closed by suture, one after three years, which died of pneumonia; at autopsy there were absolutely no evidences of ulcer to be found. The other was a patient who had an active tuberculous condition of the lung at the time of his perforation. He was operated two years later for a tuberculous peritonitis and no evidences of ulcer were to be seen.

Doctor Connors said that gastroenterostomy in the hands of Doctor Deaver was a safe procedure, but Doctor Deaver had well said "in the hands of a master"; unfortunately, most of us were not masters but unskilled. Therefore, he maintained that simple suture was the operation in perforated gastric ulcer.

Dr. Charles H. Peck said that when he looked over the series of perforated ulcers for the past eight years, on the Second Surgical Division of the Roosevelt Hospital, he found twenty-one cases, and these histories showed that they had frequently done primary gastroenterostomies. If a primary gastroenterostomy implied an additional surgical risk it was left for a secondary operation. In making the decision as to whether or not to do a primary gastroenterostomy it made a great deal of difference in what condition the patient was and how long a period had elapsed since the perforation. In this series of twenty-one perforations, there were twelve primary gastroenterostomies and nine simple closures. There were three deaths in the first series, a fairly high mortality. In the cases closed without gastroenterostomy there were many which were severe cases. Doctor Peck said he believed gastroenterostomy could be done safely in many early perforations where there was not much soiling; it could be done quickly without causing much shock to the patient, and the chances for a permanent cure were distinctly better.

Doctor Peck recalled a perforation operated upon in 1909 after twenty-nine hours, when the abdomen was full of exudate. That woman could not have stood gastroenterostomy. He had followed her for fourteen years and she had remained perfectly well without a secondary operation, and without the persistence of gastric symptoms. On the other hand, there were some cases requiring secondary operation. There were four cases requiring secondary gastroenterostomy, one fifteen years after the perforation; another eleven years after, in both instances with a good interval of freedom from symptoms. The two others required the secondary operation within shorter periods. In one of these, a man seventy-one years of age, a second operation was required within twenty-one days. This patient had a fixed duodenum and an attempt was made to suture the perforation, with the result that a fistula formed which closed in about three weeks, with complete closure of the pylorus. At this time he was in a desperate condition physically, and demented also. He was now seventy-four years old and well. In another

case the secondary operation was done thirty-two days after the first. In a good many cases if it could be done without increasing the mortality an immediate gastroenterostomy had its advantages, but, on the other hand, there are a good many cases in which fifteen or twenty hours after perforation there was a good deal of exudate and it was better policy to close the perforation and take a chance of having to do a secondary gastroenterostomy.

Dr. John A. Hartwell said that one got the impression from the paper and the discussion that statistics on this subject were of very little value, as they varied so much in the different clinics. He felt that one could scarcely lay down a rule of practice, but that each case must be considered on its merits. He had understood Doctor Deaver to say that he had never seen a perforated ulcer that could not be properly closed, and he wondered that if possibly some of the deaths reported had not been due to the failure of union or an incomplete closure, with a resultant peritonitis.

Another point brought out by Doctor Hartwell was that the production of gastroenterostomy was not a natural procedure, and a person with a gastroenterostomy was not a normal person. He had gone on the principle that the surgeon who performed a gastroenterostomy must show cause why he should do it. In other words, a gastroenterostomy was not something to be done because it was convenient, but one must show why it was a good thing. If there was an obstruction at the pylorus after the perforation was closed, then gastroenterostomy should be considered. If the patient was in good condition and there was reason to think the stomach sufficiently deformed so that the musculature would not properly function, a gastroenterostomy should be performed. Otherwise the stomach should be left in as nearly a normal condition as possible until subsequent evidence made a secondary operation advisable. Gastroenterostomy in itself was justly considered as largely a curative measure for pyloric and duodenal ulcers. It, however, was not curative for gastric ulcers, and hence the necessity of its employment in gastric perforations was less apparent than in duodenal perforations.

Doctor Deaver, in closing the discussion, said that, speaking of the surgeon with large experience and of the occasional surgeon, the occasional surgeon should not do a posterior gastroenterostomy as a routine procedure. Most of their posterior gastroenterostomies were done in early perforations. Patients operated upon after seventy-two hours practically all died whether suture alone was done or a primary gastroenterostomy added. The success of this procedure depended upon its being done early. In diffuse peritonitis few surgeons would perform a gastroenterostomy, but done in the early stage by a well-trained surgeon it was safer than simple suture, because there was less likelihood of leakage, and he believed that was one reason why it had been followed by better results. One must not lose sight of the fact, as one of the speakers had remarked, that from the physiological standpoint it might be better to go on with the stomach in its natural condition, but it must be remembered that many people with posterior gastroenterostomies were just as well as those who had never had anything wrong with their stomachs. The 80 to 90 per cent. of cures recorded by Moynihan, the Mayos, and others followed up, afforded proof of this statement.

PERICARDIOTOMY FOR SUPPURATIVE PERICARDITIS*

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This paper is based largely upon a case of suppurative pericarditis which was observed on the Second Surgical Division of the New York Hospital. It illustrates certain principles of treatment which I wish to emphasize, notably the technic of pericardiotomy and the post-operative treatment by the Carrel-Dakin method.

Suppurative pericarditis is not an excessively rare lesion, although operations for its relief are relatively infrequent. Stone found purulent pericarditis in 14.5 per cent. of 300 patients who had died of pneumonia. None of the forty-four cases had been operated upon. Stone's figures, however, are much higher than those of most observers. The variance in the statistics is due to the fact that the incidence of this complication of pneumonia varies greatly in different epidemics and in different years. The lesion may also develop secondarily to other infections besides pneumonia; may occur primarily, and may follow infection from without through a wound. A considerable proportion of the cases occur in children (Gill). The diagnosis of pericardial effusions, according to Stone, should offer little difficulty when the amount reaches 300–500 c.c. Yet, Osler states that "probably no serious disease is so frequently overlooked by the practitioner." The explanation is that the condition is frequently not thought of and its signs not sought. If there is doubt as to the purulent character of the exudate, this is readily demonstrated by paracentesis.

Because the involvement of the pericardium is usually secondary in the course of a general sepsis, and often constitutes a terminal infection, medical men have not been inclined to refer these cases to the surgeon. As a result, operations in general have not been undertaken sufficiently early nor often. Although the prognosis is extremely grave in such

* Read at meeting of New York and Philadelphia Surgical Societies, December 8, 1920.

secondary infections of the pericardium, it is not necessarily hopeless, as has been repeatedly demonstrated by the recovery of apparently moribund patients.

The report of the case is as follows:

The patient was a boy of nine years who had always been robust and healthy until the present illness. About nineteen days before admission he had a violent chill followed by cough and vomiting. On the following day the condition was recognized as pneumonia involving the right lung. Three days later the left lung also became involved. The temperature ran between 104° and 105°, and the patient became delirious. Three days before admission to the hospital, the attending physician suspected suppurative pericarditis. Dr. E. Cussler, who was called in consultation, concurred in the diagnosis and referred the patient to the New York Hospital.

Physical Examination (on admission).—The boy was emaciated, flushed, dyspnœic and evidently acutely ill. Temperature, 103°; pulse, 120; respiration, 48.

Chest. The expansion was limited on both sides; the excursions shallow and rapid. Fremitus was decreased in the right midaxilla down to the base. Percussion was slightly hyper-resonant throughout, except in right chest from anterior axillary line to the outer border of the scapula. This area was dull. Breath sounds in this area were almost absent. Throughout the remainder of the chest the breath sounds were harsh and high pitched with numerous moist râles most marked over the upper right lobe anteriorly.

Heart. The apex impulse was absent; percussion showed enlargement both to the right and left; no murmurs or accentuation were noted. At the base there was heard a slight pleuro-pericardial friction sound. All sounds were very distant and muffled.

Percussion of Heart

Space	To Right	To Left of Midline
2nd	1 cm.	2 cm.
3rd	2 cm.	4 cm.
4th	2 cm.	6 cm.
5th		9 cm.
6th		10 cm.

Extremities—No œdema. Blood—Red blood-cells, 4,640,000; hæmoglobin, 88 per cent.; white blood-cells, 19,800; polymorphonuclears, 90 per cent. Urine—10.25-acid-albumin trace, granular casts. X-rays showed pericardial effusion with sacculated fluid in external part of right chest (*cf.* Fig. 1).

Operation (April 6, 1920).—Pericardiotomy and right thoracotomy for empyema. Ethyl chloride ether anæsthesia.

The pericardium was aspirated just mesial to the outer margin of dulness in sixth space and pus obtained. Curved incision from fifth rib at left border of sternum down to seventh rib, then curving

outward along seventh, in all about three inches. The flap thus formed was lifted outward from the bony structures and about one and one-half inches of the costal cartilages of the sixth and seventh ribs were removed. The internal mammary was ligated above and below. The triangularis sterni was cut and the pericardium exposed. Two per cent. novocaine was injected in the pericardial and the pericardium opened vertically about one-half inch from the sternum. On opening the pericardium a large quantity of thick pus exuded. This was allowed to escape slowly; then the opening was enlarged. A finger introduced revealed a considerable amount of thick fibrin. This loosely bound the heart to the parietal pericardium. It was freed with the finger, and masses of it were removed with forceps. Pericardium on each side was then sutured to the superficial soft parts and a small tube and a rolled rubber dam introduced.

Needle was introduced in midaxillary line, right side, sixth interspace, and thick pus obtained. Thoracotomy in intercostal space

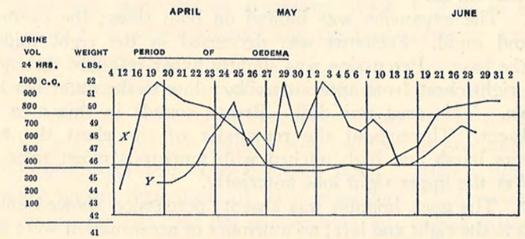

FIG. 2.—Chart showing relation between weight and urine during and after œdema. Line *y* indicates urine c.c. twenty-four hours. Line *x* indicates weight.

and large drainage tube introduced with Auchincloss apparatus attached. A rapid intercostal thoracotomy for empyema was performed without the evacuation of fluid at the time in order to diminish shock.

Post-operative Course (abstract of notes).—April 8th, second day, drains removed and two Carrel tubes, open at ends and without lateral perforations, inserted to depth of wound, about five inches. Dakin's solution was introduced very slowly by gravity; 10 c.c. every hour through each tube. The wound was dressed daily, following the Carrel technic, tubes being removed and fresh tubes reinserted. By means of a back rest the boy was kept in a sitting position most of the time.

April 9th. General condition very good. At dressing patient was lifted and turned. Only about six drops of thick, yellow pus escaped.

April 11th, fifth day, empyema tube removed for first time, little pus and small cavity. Large tube reintroduced and through it Carrel

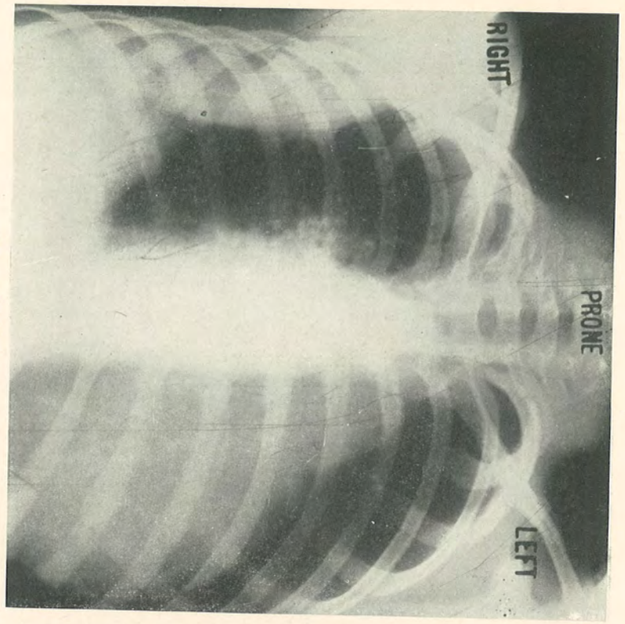

FIG. 1.—On Admission.

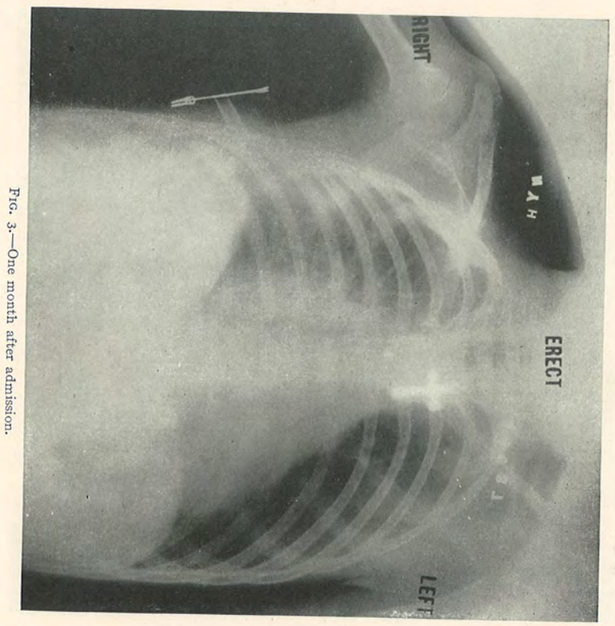

FIG. 3.—One month after admission.

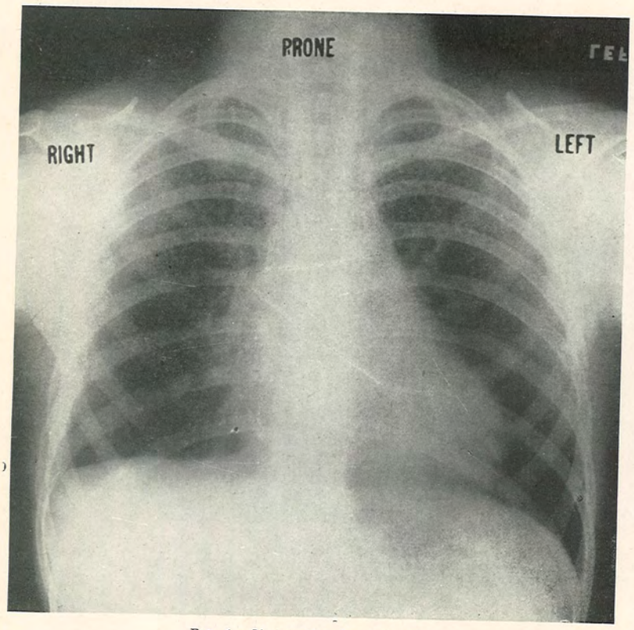

FIG. 6.—Six months after operation.

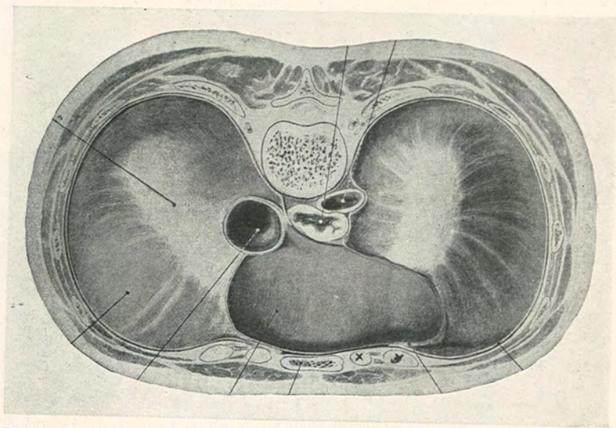

FIG. 8.—Diaphragmatic portion of parietal pericardium X = seventh costal cartilage: Y = sixth costal cartilage. (From Corning.)

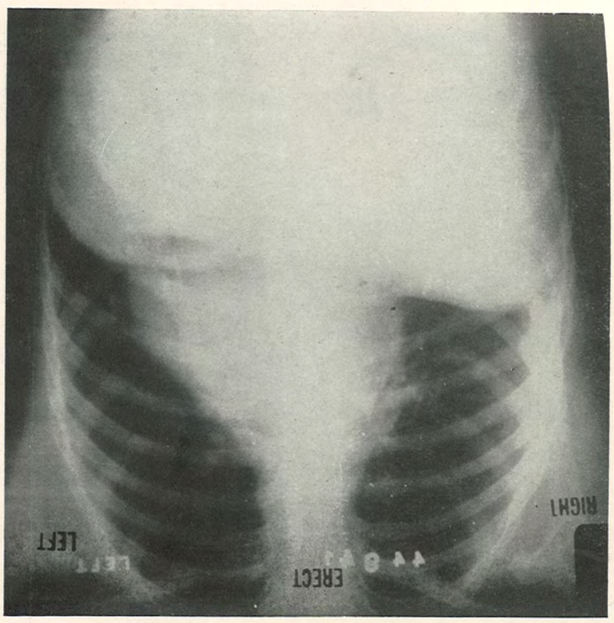

FIG. 4.—Two months after operation.

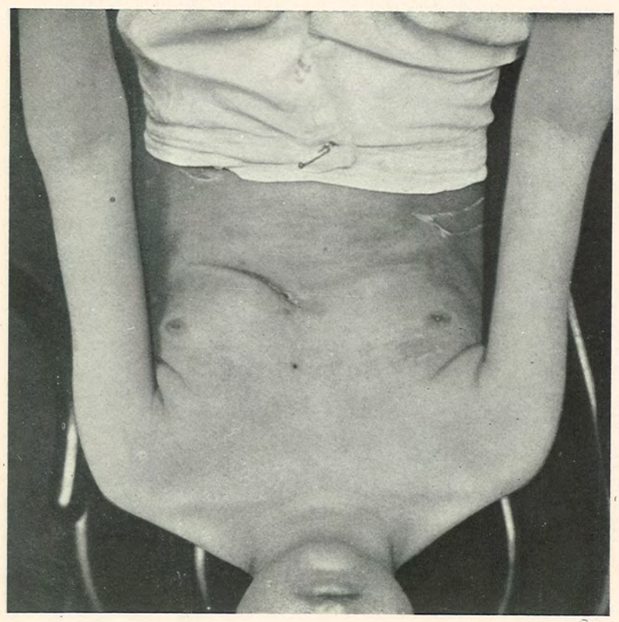

FIG. 5.—Patient on discharge June 4, 1920, two months after operation.

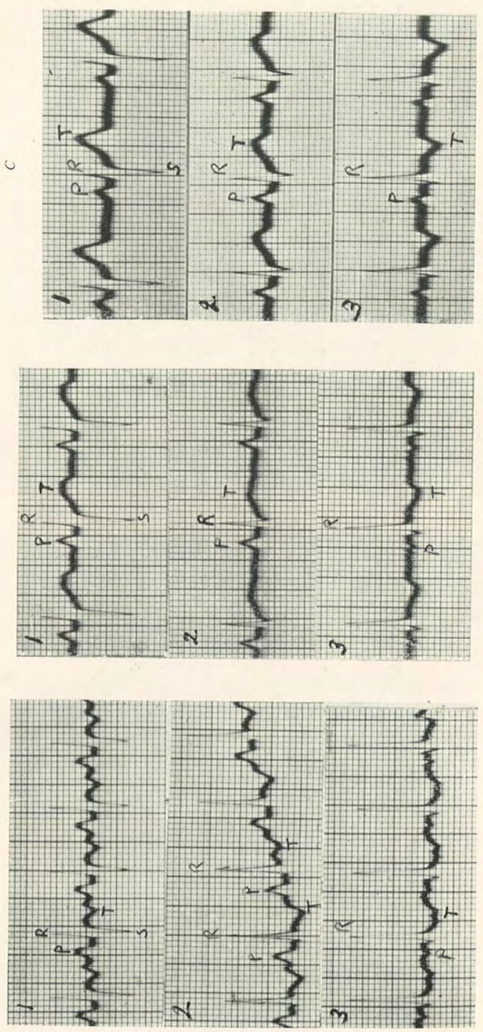

Fig. 7.—Electrocardiograms taken on three different occasions. In each record the curves are by leads 1, 2 and 3 from above downward. The vertical lines represent time and are 0.4 second apart—one-fifth of a second between every fifth line. Movements of the curve across the horizontal lines are due to variations in the amount of the heart's current, the space between ten abcisse representing one millivolt. Record *A*: May 6, 1920. Record *B*: June 11, 1920. Record *C*: October 18, 1930.

tube inserted. Ten c.c. of Dakin solution introduced thereafter every hour.

Pericardial wound. Discharge now thin and mucoid, not purulent. Only one Carrel tube introduced.

April 16th. Moderate discharge from pericardium. Abdomen distended. Œdema of face, scrotum, legs and abdomen. Patient's weight increased and urine excretion was low (*cf.* Fig. 2). Urine showed trace of albumin and few granular casts. Tincture digitalis was administered, M 140 in five days. Turned on face to allow fluid to gravitate from pericardium, little escaped. Scant discharge from empyema. X-ray showed thickened pleura on right side. Heart shadow still enlarged to left. During the first ten days temperature fluctuated from 100° to 104.6°. From this time, with one exception, it did not exceed 101°.

April 20th. Patient's general appearance improved. Temperature, 99.4°. Pulse of good quality. Not dyspnœic. Œdema of face and legs less.

April 23rd. Condition improved. Discharge less. Turned on face, practically no discharge. Œdema of abdomen and scrotum less. With the clinical improvement the weight diminished and the urine increased.

April 30th. General condition markedly improved. Small irrigation catheter passed inward four inches. Cavity held only about 2 c.c. Marked pulsation of whole precordial region. Œdema practically gone. It was believed that the œdema was due to myocarditis.

May 4th. Very little discharge from wounds. General condition improving.

May 11th. Tube shortened gradually from this time about one-quarter inch every two to three days. X-ray showed thickened pleura and pleuro-pericardial adhesions on right side. Some infiltration of right lung (Fig. 3).

May 25th. Pericardial wound very slight discharge. Tube reinserted.

May 28th. Empyema wound, no drainage. Pericardial wound practically no drainage. Drain removed. Condition good.

June 1st. X-ray showed thickened pleura, lower right (Fig. 4).

June 2nd. Examination by Dr. W. R. Williams. Mesial part of precordial scar retracted in systole. Cardiac dulness extends 2 cm. to right of midline in fourth and fifth spaces. To the left 3 cm. in second; 5 cm. in third; 9 cm. in fifth space. Heart action regular and of good quality; no thrills nor murmurs. On breathing expansion of both sides of chest good. Empyema scar at level of eighth rib; opposite this level, both in front and in back, resonance is diminished, as are also fremitus, breathing and voice. Over rest of lungs signs are normal. No râles heard at any point.

June 4th. Discharged from hospital. General condition excellent (Fig. 5).

On October 19, 1920, Doctor Williams reported as follows: On

inspection left side of chest bulges little more than right. Apex impulse definite in fifth space 8 cm. to left of midline. No retraction of chest wall with systole.

Cardiac dulness extends 3 cm. to right and 8 cm. to left of midline. Apex impulse is felt in the fifth space 8 cm. to left of midline. P-2 is greater than A-2. No murmurs heard. Rate 92, regular, sounds have good muscular quality.

Fluoroscopic Examination.—Movements of diaphragm normal—no evidence of pleural adhesions. The heart shadow somewhat more horizontal than usual; transverse diameter of the shadow was 11 cm. No systolic retraction of any ribs or costal cartilages could be seen (Fig. 6).

Electrocardiographic Report (Dr. Harold Pardee, Fig. 7).—The tracing of May 6th, taken when the pericardium was open and draining, shows the presence of a slight degree of right ventricular predominance. The "T" wave is turned downward in all three leads which indicates that the myocardium is abnormal. The "T" wave also shows a curious upward curve in lead 1 between the "S" wave and the downward peak of the "T" wave, which is often found when the myocardium is the seat of a focal process. The auricular waves are normal and the "P"-"R" interval is normal, showing that there is no disturbance of the conduction system between the auricles and ventricles.

The record of June 11th, taken when the wound was closed and the patient up and about, shows a more normal-appearing electrocardiogram. The right predominance is still present and is more marked, but the "T" wave does not show the abnormal direction which it did in the previous record. This is probably due to an improvement in the myocardial condition which was previously present.

The record of October 18th shows very little change from that of June 11th, except that the right ventricular predominance is still more marked. This increase of the right ventricular predominance is probably due to the mechanical difficulty which this ventricle meets in contracting; possibly as the result of adhesions.

Summary of bacteriologic examinations made by Doctor Wheeler. The first cultures in this case were made at the time of operation on April 6th. Specimens of pus from pericardium and from pleural cavity were placed in tubes of broth, from which blood agar plates were inoculated. A pure culture of pneumococcus, Group IV, was obtained from the pericardial pus; the culture of pus from the pleural cavity remained sterile ten days. The pneumococcus, Group IV, isolated from the pericardium showed characteristic colonies on blood agar plates, had a distinct capsule, was bile-soluble, fermented inulin and was not agglutinated by any of the three types of anti-pneumococcus immune serum.

On April 16th, ten days after operation, cultures of pus from pericardium showed a pure growth of streptococcus hæmolyticus. The

hæmolysis produced was slight, but the organism grew typically in long chains, in broth, had no capsule, was not soluble in bile, and did not ferment inulin. No pneumococci were found in these cultures. Cultures of pus from pleural cavity showed a hæmolytic streptococcus similar to that just described and many colonies of staphylococcus aureus.

Repeated cultures of pleural and pericardial exudates made at intervals of one to five days always showed a typical hæmolytic streptococcus producing well-marked hæmolysis on blood agar plates. No pneumococci were found in any of these cultures. At times secondary invaders were present; staphylococcus albus, a non-motile, non-liquefying, gram-negative bacillus and a diphtheroid bacillus; but these disappeared subsequently and the final cultures showed in each instance a pure growth of streptococcus hæmolyticus.

When last seen in December, eight months after the operation, the boy was apparently in normal health and was able to exercise, as before the operation without embarrassment. The two costal cartilages apparently had reformed except at junction with sternum, where a narrow cleft could be felt.

Technic of Pericardiotomy.—Numerous procedures have been recommended for drainage in suppurative pericarditis. They need not be reviewed in detail. Two features, however, have become generally accepted: first, that the approach and drainage should be to the left of the sternum, and second, that no procedure should be employed which does not drain the lowest part of the pericardium. Although patients have recovered after removal of fourth, fourth and fifth, and fifth cartilages and incisions through the fourth or fifth space, such methods of approach should not be elected, since they do not provide a direct tract beneath the heart to the deep recesses on each side of the inferior vena cava.

Methods which are planned to drain the dependent part of the pericardium include resection of the sixth cartilage (Voinitsch, Kocher); resection of the fifth and sixth cartilages (Delorme et Mignon); resection of the sixth and seventh cartilages with adjacent sternum (Voinitsch, Rehn); resection of the seventh (Mintz), and the epigastric route (Allingham). The epigastric or subcostal approach through the diaphragm is a rapid but rather blind procedure; moreover, it endangers the peritoneum and is very limited in extent, especially in adults (Cotts and Rowlands). Since this method cannot be recommended, the indications would appear to demand some procedure by which drainage is secured through resection of one or more of the lower costal cartilages.

Resection of a single cartilage, preferably the sixth, is not adequate for prolonged drainage. The relatively narrow tract rapidly contracts. It cannot be kept open with a rigid tube, as in an empyema, on account of contact of the tube with the heart. If the case does not do well and a deep accumulation of pus is suspected, exploration and reintroduction

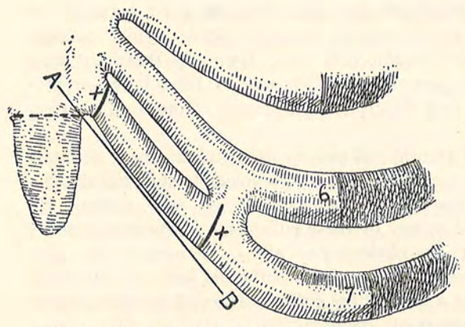

FIG. 9.—Mintz method, resection of seventh cartilage.

of drain is difficult and necessitates some traumatism to the heart. These disadvantages of the method were forcibly demonstrated in a personal experience. Accordingly, in the case here reported, it was decided to make a more extensive exposure. Resection of the fifth and sixth cartilages was considered but rejected because the drainage is not as low as possible, and resection of the sixth and seventh cartilages was elected. This procedure was a marked improvement, yet it did not give as free exposure as is desirable. An effort, therefore, was made to plan a more satisfactory operation which will give ample exposure and provide the essential dependent drainage; and with this object the anatomy of the parts was reviewed.

The relations of the heart and pericardium to the thoracic wall need not be outlined. Admirable descriptions are given by Moritz, Corning, and others. The diaphragmatic portion of the parietal pericardium, however, must be referred to, since it is along this surface that the drain should lie. Illustration shows relation of this surface to thoracic wall (Fig. 8). Since the sternal portion of the seventh cartilage is above the diaphragm and usually overlaps the pericardium, removal of this part of the cartilage is indicated to ensure dependent drainage. Mintz even limited his operation to resection of the seventh cartilage (Fig. 9).

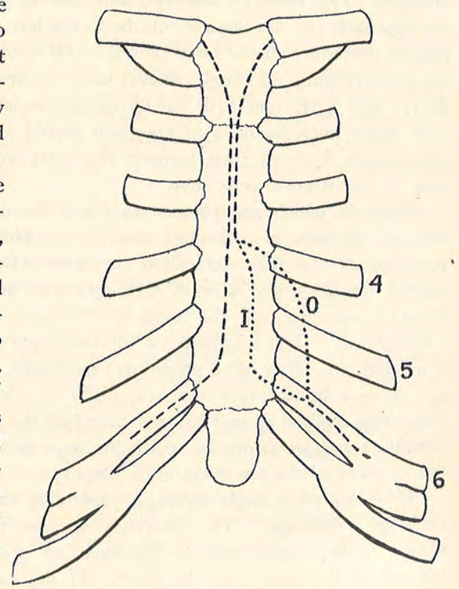

FIG. 10.—Reflection of pleura. On left side the anterior limits of pleura may lie anywhere between the dotted lines. The outer position (0) is the most frequent: the inner (1) the least frequent.

The anterior reflection of the left pleura is relatively close to the sternum, yet varies somewhat. The limits most often noted are defined in the illustration (Fig. 10). With distention of the pericardium the reflection is said to be displaced slightly outward; moreover, adhesions may occur and close to some extent this part of the pleura by agglutination between its surfaces. However, reliance cannot be placed on these factors. It is obvious that a pericardial incision parallel to the ribs is likely to open the pleura unless the incision be extremely short; while a vertical incision close to the sternum will usually safeguard the pleura. The first requisite, therefore, is that the pericardium be opened in a vertical direction close to the sternum.

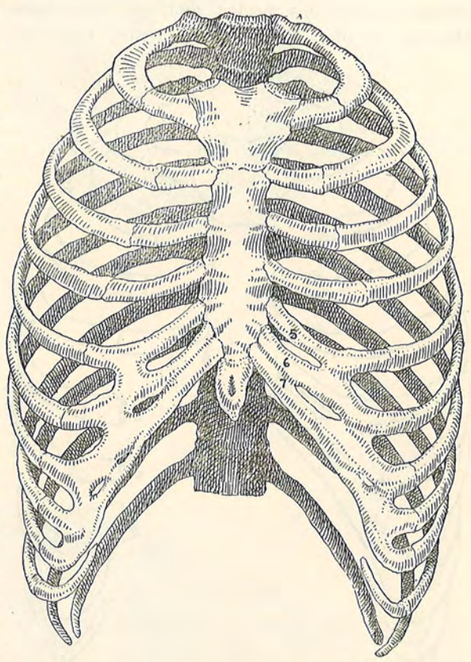

FIG. 11.—Bony structure of thorax. (From "Gray's Anatomy." Twentieth Edition, 1918, p. 116, Fig. 112.)

Study of the bony thoracic structure shows that it is subject to wide variations, but the general arrangement as evidenced by dissections and illustrated in anatomies (Fig. 11) shows a close relationship between the sixth and seventh cartilages with little intervening space. Moreover, the fifth space is often narrow. Consequently, the removal of the sixth and seventh cartilages gives relatively little exposure in a vertical direction. The fourth space, on the other hand, is wide; consequently, the additional removal of the fifth cartilage adds greatly to the exposure in the vertical direction while it adds little to the severity of the operation. Therefore, if it is accepted that a vertical incision in the pericardium should be made, an adequate opening is best obtained by the removal of portions of the fifth, sixth, and seventh cartilages (Fig. 12). This allows approximately a two-inch incision in the adult as demonstrated on the cadaver.

Such a relatively extensive exposure has the additional advantage of favoring post-operative drainage. The importance of this factor cannot be too strongly emphasized. As Ballance states, "In reading the records of cases of suppurative pericarditis, one is struck with the almost universal difficulty experienced in maintaining drainage." The situation of the exudate in the distended pericardium explains this (*cf.* Figs. 13 and 14). In a large proportion of cases pus accumulates after operation in the depths of the pericardium, especially in the left cul-de-sac. The heart descends over this pocket and the lung intrudes laterally, assisting in shutting it off. The drainage track may thus easily become blocked. Further, the incision through the soft parts tends to close with surprising rapidity as has been emphasized by Rhodes and others. With tract thus narrowed and blocked reintroduction of a drain or exploration of the depth of the wound is a difficult, dangerous, and blind procedure. A liberal exposure will tend to avoid these difficulties.

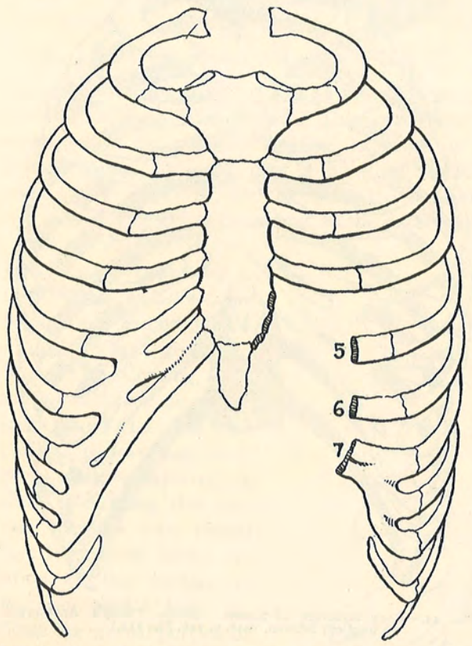

FIG. 12.—Exposure after removal of fifth, sixth and seventh cartilages.

The following operative procedure is suggested. It is a modification of the method presented by Delorme and Mignon.

The incision (Fig. 15) begins at middle of sternum at level of the lower margin of fourth costal cartilage; curving it passes downward and to the left to upper margin of chondrosternal junction of fifth; then downward close to the left edge of sternum, crossing the fifth and sixth cartilages to the middle of the seventh cartilage; curving outward it follows the seventh cartilage. The soft parts are freed and retracted, the resulting wound being an elipse. The seventh costal cartilage is divided at sternum. The soft parts are detached along its borders and the cartilage is lifted. It is easily freed from the perichondrium posteriorly. A complete subchondral resection is not attempted because the perichondrium anteriorly and

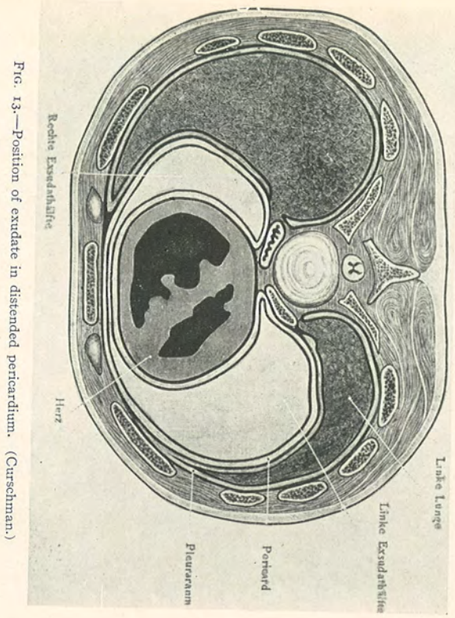

FIG. 13.—Position of exudate in distended pericardium. (Curschman.)

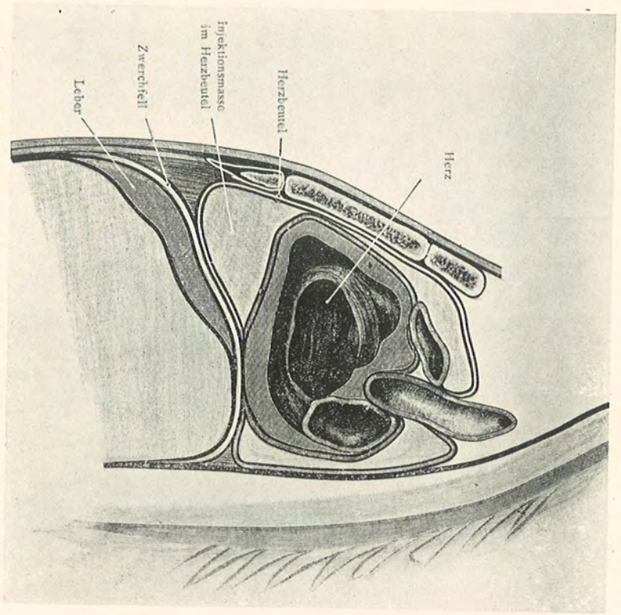

FIG. 14.—Position of exudate in distended pericardium. (Curschman.)

FIG. 16.—Cartilages resected, leaving posterior perichondrium and internal intercostal muscles.

FIG. 15.—Incision for pericardiotomy

FIG. 17.—The layer including internal intercostal muscles and posterior perichondrium incised vertically, exposing internal mammary vessels. (T. S., triangularis sterni.)

FIG. 18.—Triangularis sterni separated from sternum. Finger displacing fat and pleura outward to expose pericardium (Po).

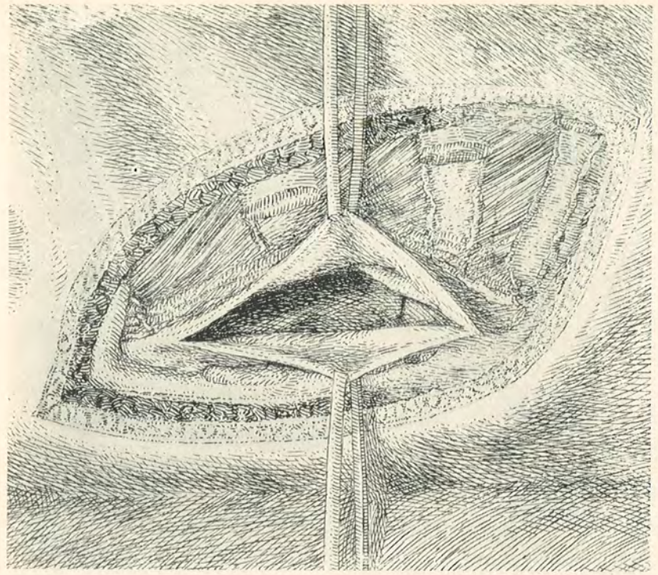

FIG. 20.—Pericardium opened, showing heart and diaphragm.

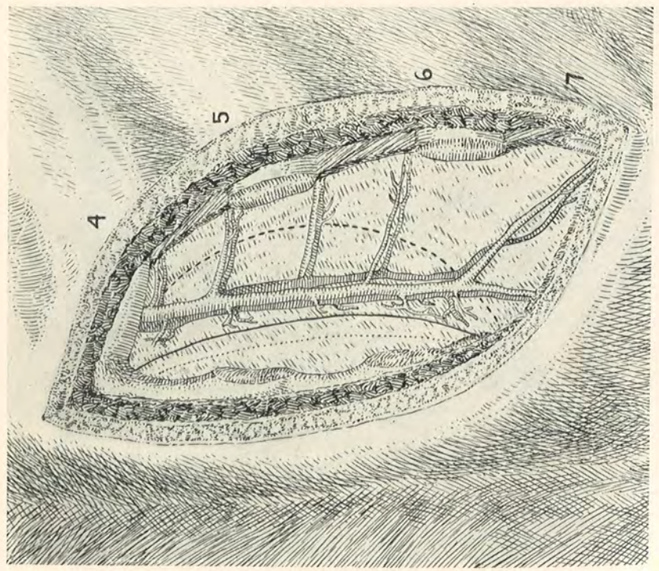

FIG. 19.—Diagrammatic: Portions of fifth, sixth and seventh cartilages removed. Approximate relations of lung, pleura and internal mammary vessels to line of incision in pericardium. - - - lung; ——— pleura; . . . . line of pericardial incision.

at the borders is firmly adherent and is separated with difficulty. The cartilage is fractured about two inches from its sternal end and removed. The same procedure is carried out with the sixth and fifth cartilages (Fig. 16). The thin layer, including internal intercostal muscles and posterior perichondrium, is incised vertically and easily separated from the underlying tissues. This exposes the internal mammary vessels (Fig. 17). At the upper part of the wound they lie about one-half inch from sternum. They should be ligated above and below to lessen the danger of secondary hemorrhage. The thin triangularis sterni is separated from the sternum, and with finger or blunt instrument the underlying fat, and with it the edge of the pleura, is displaced outward (Fig. 18). The pericardium is thus exposed and is opened between forceps, about one centimeter from the edge of the sternum (Fig. 20). The incision should extend downward to the reflection of pericardium to the diaphragm. While the incision is in general vertical, it is advisable that it be slightly curved with concavity towards the sternum. This allows better separation of the edges and favors drainage. If possible the edges of the pericardium should be sutured to the skin or superficial soft parts to diminish the danger of mediastinitis.

Objection to removal of three cartilages may be urged on the ground that these patients are in too serious condition to warrant so extensive an operation. Yet in nine of the reported cases two cartilages were removed and eight of these cases recovered. The additional removal of a third cartilage should not be of serious import and should be more than counterbalanced by the advantages. Further objection may be raised that the operation is too extensive to be undertaken under local anæsthesia. This will depend upon the case and the operator. But it may be stated that general anæsthesia can be supported in a considerable proportion of cases. Of the reported operations in which a note has been found as to the type of anæsthesia twelve were general; over 50 per cent. recovered.

The question of drainage is important. In the case here reported the drain was removed in about thirty-six hours, two Carrel tubes were substituted and Dakin's solution introduced regularly. In another case I should begin the Carrel-Dakin method at once. It was here undertaken with some trepidation because it had apparently never been employed in the pericardium and I was uncertain as to its effects. Yet its indications seemed to demand it. On the basis of a former experience and the study of case reports, it was felt that thick pus with fibrin was likely to wall off the cavity into chambers, resulting in retained excretions and imperfect drainage, especially of the left recess. It was believed that the solvent effect of Dakin's solution would obviate this risk and would soon render the excretions thin and less in volume, besides gradually sterilizing the cavity. Practice confirmed the theory. Improvement was striking and sustained. The solution apparently exerted no noxious influence upon the

pericardium and may, I think, be employed with confidence and advantage in subsequent cases.

Immediate Results.—Roberts, 1897; Porter, 1900; Eliot, 1909; and Rhodes, 1915, have collected the reported cases of pericardiotomy for suppurative pericarditis. According to Rhodes, the cases numbered eighty-six, of which forty-five recovered and forty-one died, a percentage of 52.3 recoveries against 47.7 deaths. In the series the organism was reported in twenty-one only, the pneumococcus was found in nine cases, staphylococcus in four, streptococcus in three, a mixed infection of streptococcus and staphylococcus in two, the colon bacillus in one, the bacillus pyocyaneus in one, and a double coccus in one. The reports, however, are of very limited value for analytical study since details are often lacking. This illustrates the importance of full reports, not simply operative results, in such unusual cases.

An effort to collect more recently reported cases has added thirteen. It is noteworthy that the six cases which followed traumatism recovered, while of the seven non-traumatic cases only two recovered. This brings the total to ninety-nine cases with fifty-three recoveries and forty-six deaths. Summaries of these cases are appended.

Late Results.—The ultimate prognosis in a case of adherent pericarditis depends not only upon the extent and density of the intrapericardial and mediastino-pericardial adhesions, which may restrict the cardiac activity, but to a large extent upon the degree of myocarditis. In suppurative pericarditis the heart substance is always involved to some extent in the inflammatory process; degenerative and fibroid changes result and if extensive lead to dilatation. Resulting circulatory disturbances are often of late development. They are evidenced, according to McPhedran, chiefly by palpitation, tumultuous heart action, dyspnœa, a tendency to syncope and cyanosis, finally signs of cardiac failure, such as anasarca and ascites, may supervene. On the other hand, according to the same author, light adhesions with little myocarditis may give rise to no functional disturbance.

To what extent myocarditis and adhesions cause functional derangement in drained cases of suppurative pericarditis is not evident from clinical observation. In only a few cases are the results recorded a sufficient period after operation to be convincing. Good functional results were reported in the following: Lilienthal's case, twenty years after operation; V. Eiselberg's case (Walzel), a boy of nine, was well nine years after operation, Kiliani's patient, seven years; Eliot's, two years; Peters', a boy of seven, eleven months; the case here reported, eight months. Other cases, with the exception of Davis' case, are not reported later than four months. In two cases poor functional results are recorded; Davis' patient, a boy of eleven, one year after operation showed marked adhesive pericarditis; LeConte's patient (Scott), a male, aged thirty-six years, four months after operation palpitation persisted and prevented return to work.

Presumably the earlier the drainage the less will be the myocardial involvement; moreover, it is possible that early treatment with Dakin's solution will diminish pericardial adhesions. Certainly the functional results will not be prejudiced by early drainage, while the immediate mortality will be reduced by timely operative intervention.

CONCLUSIONS

The method here described (resection of portions of the seventh, sixth, and fifth cartilages) meets the most important indications, namely, it opens the pericardium at its lowest part; involves little risk of injury to the pleura; provides ample drainage and allows such exploration as is necessary both at the time of operation and during the post-operative course. If the condition of the patient warrants it, I believe this method is advisable, especially if a brief general anæsthetic can be tolerated. In some cases, a less extensive exposure may seem imperative. Under these conditions resection of the sixth and seventh cartilages seems best. The procedure was employed in the case here reported and gave quite satisfactory exposure and provided efficient drainage. In conjunction with the Carrel-Dakin method it probably would prove adequate for many cases. Resection of the sixth cartilage alone may be done readily under local anæsthesia and is tempting by reason of its simplicity, but the drainage is not satisfactory.

The Carrel-Dakin method appears well adapted to the post-operative treatment of suppurative pericarditis.

Cases Reported Since 1915:

Barié and Lebert: *Bull. et Mém. Soc. Méd. Hôp.* de Paris, 1915, xxxv, 1042.

Pyopneumopericardium was observed in a man thirty-one years of age whose condition was not recognized accurately until five months after the onset of the disease, when pericardiotomy was performed.

Extremely offensive gas escaped, as well as a small quantity of offensive grayish fluid. Bacteriological examination showed staphylococci in large numbers and rod-shaped bacteria. The patient died six days after operation. Autopsy showed that the pyopneumopericardium was the result of œsophageal perforation, caused by a broken down tuberculous mediastinal gland. The œsophagus became ulcerated and then perforated the ulcerative process extending to the pericardium, which also became perforated, with establishment of a fistula between the œsophagus and the pericardium.

Boidin, M.: *Presse Méd.*, Par., 1916, xxiv, 523.

Observation on a case of suppurative pericarditis caused by a small focus of superficial pulmonary gangrene, which was adherent to the pericardium and had infected the latter. The suppurative pericarditis behaved like a primary pericarditis. It was first punctured, and then treated surgically, but terminated in death.

Robey, W. H., Jr.,: *Am. Jour. Med. Sc.*, 1917, cliii, 529.

This paper is based upon a study of the protocols of eighty proved cases of acute pericarditis and the literature particularly of the preceding five years. It seeks to emphasize certain physical signs which have seemed of importance to the writer.

1. Man, aged thirty-two years. Had been ill two weeks with pneumonia, was improving, then grew worse. Diagnosis of pericarditis with effusion was confirmed by

Röntgen-ray examination. Needle inserted, gave 20 c.c. of sero-purulent fluid. Operation, two quarts of pus removed. Patient relieved, but died a few hours later.

2. Case of purulent pericarditis following pneumonia. Exploratory puncture made in fourth space to the right of sternal margin and operation followed, the fourth and fifth costal cartilages being resected. The patient made a good recovery and the discharge ceased in three weeks.

DAVIS, C. B.: Suppurative pericarditis. Demonstration of a case one year after operation. *Surgical Clinics of Chicago,* 1917, i, 375.

The patient, a boy eleven years of age, entered the hospital with multiple suppurating bone foci culminating in an attack of suppurative pericarditis. Exploratory puncture close to the sternum in the fifth intercostal space yielded pus; the fourth and fifth costal cartilages were resected for an inch and the pericardium exposed. An artery forceps was forced into the pericardial cavity by the side of the exploratory needle and a large quantity of pus allowed to escape slowly. A soft rubber tube was sutured in the pericardial cavity and drainage was continued for several weeks. The pericardial shadow diminished, as was shown by X-ray examinations, and the pericardial wound healed in about four weeks. Bacteriologic examination showed pure cultures of staphylococcus aureus in all lesions. One year later, physical examination showed the presence of adhesive pericarditis, the pericardium being not only adherent to the heart, but also involved in a chronic mediastinitis and fusion of the pericardium with the pleura and to the chest walls. It is stated that besides being a good example of acute suppurative pericarditis successfully treated in respect to the immediate lesion, this case illustrates the typical postoperative results showing why the ultimate prognosis is so unfavorable, especially in children.

WILLIAMSON, C. S.: *Medical Clinics of Chicago,* 1917, ii, 907.

Patient, man aged forty years, with symptoms of acute miliary tuberculosis; duration of illness eight days, with fever, chilliness, cough, and pain in the left side. The physical signs indicated pericarditis with effusion, and the fluoroscopic findings confirmed this assumption. A purulent exudate was suspected on account of the high leucocyte count, and diagnostic aspiration of the pericardium yielded thick creamy pus, which contained the pneumococcus in pure culture. Under local anæsthesia with novocaine, the cartilage of the fifth rib was removed subchondrally and pericardium opened. Sixteen ounces of thick creamy pus, shown later to contain pneumococci, was removed. On digital exploration, no adhesions or walled-off pus cavities were found. Three guttapercha drains were placed in different parts of the pericardium, drainage remained profuse to the end, seventeen days after operation, which was followed at first by temporary improvement. The autopsy showed acute fibrinous purulent pneumococcal pericarditis and hypostatic pneumonia of the dependent portions of both lungs, besides old calcified tuberculosis of the right lung.

CAMAC AND POOL: *Amer. Jour. Med. Sciences,* 1917, cliii, 509.

Male, aged forty-seven years, pnuemonia lower right base. Twelfth day thoracotomy for empyema; staphylococcus aureus. Eight days later signs of pericardial effusion. Exploratory puncture revealed purulent exudate. Pericardiotomy under local anæsthesia, excising sixth cartilage; considerable pus evacuated. Two rubber tubes for drainage. Pus showed same organism as empyema. Marked temporary improvement, but sixth day femoral phlebitis. Blood culture showed staphylococcus. On thirteenth day after pericardiotomy patient died.

GUILLERMO, M. L., AND MONTOYA, J. M.: Pericardiotomy, suppurative pericarditis. Pericarditis supurada y pericardotomia. Report de Med. y Cirug. Bogota, 1917, ix, 115. (Abs. *Surg., Gynec. and Obst.,* 1918, xxvii, 217.)

Boy, aged eight years. Suppurative pericarditis following injury in precordial region. Under clinical observation for some time. No improvement. Operation: Under chloroform; transverse incision about 5 cm., starting from the sternal edge along fifth costal cartilage. Pericardium exposed, opened, and a quantity of bloody fluid drawn off; cigarette drain inserted; incision partly closed. Child able to get up on twentieth day, and made a normal and complete recovery.

The following cases resulted from wounds by projectiles:

ALBRECHT, P.: *Wiener Med. Wchschrft,* 1920, No. 1, p. 35.

Patient, twenty-one years of age, had been wounded in the chest by a bullet, but remained only a few days in the hospital. Soon after his discharge dyspnœa and palpitation developed, suppuration in the pericardium was suspected, and pericardiotomy was done. The projectile could not be found on exploration of the pericardium, which contained much sero-purulent fluid with some fibrinous adhesions. The adhesions were detached and the wound was drained; the drainage-tube was covered with a rubber stall in order to prevent the aspiration of air. The pulse-rate dropped to about 80 soon after the operation, and the patient made a good recovery.

JONES, L.: Gunshot wound of the pericardium and heart. Pneumohæmo-pericarditis. Operation. Recovery. *British Journal Surgery,* 1916, iv, 103.

Patient a soldier, aged thirty-eight years, who was wounded by high-explosive shell and admitted to hospital with two shell wounds of the chest-wall. The wounds were infected. Diagnosis of pericarditis was confirmed by X-ray examination. The extensive dulness was seen to be sharply localized and due to an extensive pericardial effusion. Operation under ether anæsthesia. Incision following the border of the seventh costal cartilage and the middle of the sternum; portions of the seventh, sixth and fifth costal cartilages and half the width of the sternum were removed; the pericardium was incised vertically for two inches. A large quantity of foul-smelling gas, and offensive fluid measuring 22 ounces escaped. The foreign body was not in the pericardium. A flanged rubber drain introduced into the pericardial sac. Part of the wound sutured. Iodine solution was used for flushing the pericardial cavity until the wound had entirely healed, which occurred in seven wekes. Electrocardiograph examination three and a half months later showed no evidence of hypertrophy or dilatation. No murmurs were heard; none of the cardinal signs of adherent pericardium were observed. An X-ray plate showed that there was no increase in the size of the heart. Patient in good condition.

KLOSE, H.: Ueber eitrige Pericarditis nach Brustschüssen und pleurale Pericardiotomie. *Beitrage zur klin. Chirurgie,* 1916, ciii, Kriegschirurg Heft, vi, p. 556. Medical supplement, *Daily Review of the Foreign Press,* 1918, i, 53.

The author reports four cases of suppurative pericarditis following bullet wounds of the chest. Three died, and one recovered after extrapleural pericardiotomy under local anæsthesia by Rehn's costo-xiphoid incision.

CRABTREE: *Med. Press,* London, 1919, n. s., cvii, 472. A Case of Successful Operation for Wound of the Heart.

Soldier, struck in chest by spent bullet, November 8, 1918; admitted to No. 22 General Hospital on November 9th. Entrance wound two and one-half inches to the left of sternum between fourth and fifth ribs; slight purulent discharge; pericardial friction over whole cardiac area; no evidence of fluid; chest clear. X-ray examination showed bullet in heart shadow. Bullet moved with heart's impulse. In view of extreme pain and infected pericardium operation was determined upon.

November 13th. Eight-inch incision made to the left of sternum, curving outward along the sixth rib. Fourth and fifth costal cartilages and one inch of each of corresponding ribs resected. One-half inch of left margin of sternum was removed. Pericardium was opened by a T-shaped incision to give access to extreme left side of heart. Considerable thin pus escaped. Area of fibrin and adhesions was found between the visceral and parietal pericardium on the extreme left surface of heart near the junction of the left auricle and ventricle. The bullet was found to lie tangentially to the cavity of the heart, buried in the heart muscle, but had not penetrated cavity. Owing to sepsis, the wound in the heart was not sutured after the removal of the bullet. The

incision in the pericardium was loosely sutured about the rubber tissue drain. Muscle and skin flaps were sutured into place. Recovery was uneventful, save for the collapsed left lung. March 13, 1919, patient was well.

The report states that this was the twelfth case of heart injury in the British Army to be operated upon, and was one of the four recoveries.

NOBLE, T. P., AND VINE, A. B.: Note on a Case of Pericardiotomy. *Lancet,* London, 1919, i, 107.

Soldier. Pericardiotomy performed on twelfth day after passage of rifle bullet through chest, with recovery of patient.

Wounded April 11, 1918. Bullet entered in the third interspace, one-half inch internal to nipple line on the left side, exit one and one-half inches to the left of midline behind, on a level with seventh dorsal spine. Apparently punctured pericardium and grooved muscular wall of heart. April 21st, symptoms bad; X-ray confirmed pericardium distended with fluid.

Operation.—General anæsthesia with chloroform and ether. Incision along fifth rib and cartilage from midline to nipple line, fifth costal cartilage resected, vertical incision in pericarduim; finger insinuated between right auricle and pericardium and left ventricle and pericardium; escape of quantity of cloudy fluid, which was found to contain a short streptococcus. Glove drains inserted to the right and left inside the pericardium, wound closed; drains removed two days later, wound healed by first intention. Recovery in four weeks, and improvement maintained two months later.

BIBLIOGRAPHY

Stone: Journal American Medical Association, 1919, lxxiii, 254.
Sill: Brit. Med. Jour., 1907, 606.
Voinitsch: Rev. de Chir., 1898, xviii, 993.
Kocher: Chirurgische Operationslehre, 1907.
Rehn: Arch. f. klin. Chir., 1907, lxxxiii.
Mintz: Zent. f. Chir., 1904, xxxi, 519.
Allingham: Brit. Med. Jour., 1904, i ,106; Lancet, 1900, i, 693.
Coutts and Rowlands: Brit. Med. Jour., 1904, i, 9.
Moritz: Münch. med. Woch., 1902, No. 1.
Corning: Lehrbuch d. Top. Anat., 1914.
Ballance: Lancet, 1920, i, 1, 73, 134.
Delorme et Mignon: Rev. de Chir., 1895, xv, 797.
Curschman: Die Therapie der Gegenwart, vii, August, 1905.
Roberts: Amer. Jour. Med. Sc., 1897, cxiv, 642.
Porter: ANNALS OF SURGERY, 1900, xxxii, 769.
Eliot: ANNALS OF SURGERY, 1909, xlix, 60.
Rhodes: ANNALS OF SURGERY, 1915, lxii, 660.
Lilienthal: Case report, Dec. 8, 1920, New York Surgical Society.
Walzel: Mittlg. a. d. Grenzgeb. de Med. u. Chir., 1913, xxv, 264.
Kiliani: ANNALS OF SURGERY, 1909, xl, 142.
Peters: Edinb. Med. Jour., 1903, xiii, 209.
LeConte: (Scott), N. Y. Med. Jour., 1904, i, 198.

GASTROENTEROSTOMY IN ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM*

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IT is but a few years since the surgeon first began to save from certain death the victims of that most dramatic of acute abdominal seizures, perforated ulcer of the stomach and duodenum. Yet most of the points concerning its treatment can already be regarded as settled.

All success is based on early treatment. Better an early operation by an indifferent surgeon than a late operation by a master. The second essential is efficient suture of the opening. Successes are occasionally reported by other means such as tamponade, drainage to the ulcer site, omental plugs, the use of an adjacent structure as an occlusive patch, or the suture of a tube into the opening to form an external fistula. Such makeshifts are more apt to succeed in gastric than in duodenal ulcer, but in both they are accompanied by prohibitive mortality and in no sense and under no circumstances do they rival direct closure. I have never failed to effect a direct closure by suture and can scarcely picture a case of perforation into the free abdominal cavity in which the surgeon who is familiar with the exposure, mobilization and suture of viscera could find it impossible to close a spontaneous perforation.

So far do these two fundamental principles of treatment transcend all others in importance that contributions bearing on other points in the procedure must occupy a distinctly subordinate place. Nevertheless, such considerations are important and the judgment with which they are employed will be reflected in mortality percentage.

I have never felt it was wise to advocate the excision of perforated ulcers, though there are many early cases in which, doubtless, the operation could be performed with great safety. Rövsing and certain Swedish surgeons have reported excellent results and a very low mortality in selected cases. In only one instance have I felt justified in removing the ulcer by partial gastrectomy, and this was in the case of a patient who perforated while in the ward awaiting operation, so that to all intents and purposes it could be treated as a clean case. The lesion was a large callous ulcer of the lesser curvature near the pylorus with a history of fourteen years' duration. It seemed a suitable case surgically and pathologically for excision, and the fact that it had just perforated spontaneously was

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not allowed to influence the decision to remove it. The patient recovered, though it was evident that the shock of perforation appreciably added to the strain of the operation which ordinarily is not productive of shock. In general surgeons are agreed that excision of acute perforated ulcer, as ordinarily seen a few hours after its occurrence, offers nothing of immediate life-saving value to compensate for the added time and trauma of the operation.

However, concerning simultaneous gastrojejunostomy in the treatment of perforated ulcer there is as yet no general agreement. The arguments pro and con have become rather familiar to most of us and are largely theoretical. Statistics of results which have been offered in favor of one or the other contention have been very confusing for the reason that early operation and skilful closure of the perforation so overshadow every other consideration that it is difficult to draw conclusions concerning the advantages or disadvantages of adjuvant procedures. Still it is our belief that experience will eventually point out the best method and to this end reports of individual results are still desirable.

It is now about fifteen years since we adopted the primary posterior gastrojejunostomy as a feature of the operation for acute perforated ulcers of the stomach or duodenum. Since that time in my service in the Lankenau Hospital of Philadelphia, sixty-seven acute perforated ulcers of the stomach or duodenum have been operated upon with five deaths, a mortality of 7.5 per cent. The earlier cases have been reported previously on several occasions. During the time of the preparation of this paper, owing to temporary conditions obtaining in the record room of the hospital incident to expansion of space and clerical force, a number of the earlier records have been unobtainable. We have therefore based the statistical study of this paper on the last fifty-five cases, among which there were four deaths.

It is remarkable that there was but one female to fifty-four males in this series. In Philadelphia perforating ulcer in the female is a rare occurrence, the proportion being much below that of the clinics in the British Isles and European countries. Seventeen ulcers were gastric, including the one female, and thirty-eight were duodenal. Eighty per cent. of the cases occurred between the ages of twenty-five and forty-five years, and the decade of greatest incidence was the fourth, which contained 40 per cent. of the total number. The ages ranged from twenty years to sixty-one years.

This series confirms the many able descriptions of the clinical picture and diagnostic features of the condition. A history of previous indigestion is common. In approximately one-half the cases (28) there was a clear history of gastric disturbance of ulcer type preceding the perforation. Approximately one-quarter (14) gave a history of previous indigestion of slight, occasional, or non-distinctive character, while the remaining quarter (13) gave no history or such a vague history of indigestion that no importance could be attached to it. It is still worth noting for the benefit of those who lay stress on bleeding as a sign of ulcer that hæmatemesis

and melæna were each encountered but twice in the previous history of the entire series. The duration of gastric disturbance before perforation varied from two weeks to thirty-two years. Perforation may be said to have been the first symptom in about 20 per cent. Of the cases whose symptoms should have apprised the attending physician of the existence of organic abdominal disease, but few (4) perforated within the first year of symptoms. Twenty-eight cases (51 per cent.) perforated during the the first eight years of symptoms, being quite evenly distributed throughout that period.

Excruciating pain marking the moment of perforation, followed promptly by abdominal rigidity so marked as to merit the common term "board-like" were the distinguishing diagnostic features. Initial vomiting almost always occurred, but was not invariable. Tenderness paralleled rigidity, being most marked over the most rigid area. The greatest rigidity was usually in the epigastric region, though as time went on the lower abdomen, particularly the right side, became quite as spastic as the upper zone.

The amount of initial shock is difficult to determine, as the patient is rarely seen in the first throes of the seizure. There is reason to believe that a certain amount of shock is common immediately following perforation, but at the time the patient was first seen, true shock was not present. It was not uncommon for a patient to exhibit pallor and the facial expression of desperate illness, but it was seldom that the apathy, rapid feeble pulse, and low blood-pressure which characterize true shock were observed. Often reaction had occurred, the temperature, pulse and respiration were but little disturbed, and the diagnosis depended chiefly upon the history and the abdominal signs. Attention has repeatedly been drawn to this so-called latent period in perforating ulcers.

On admission the temperature range in this series was from 96° to 100.4°, the average being 98.2°. The pulse varied from 64 to 152, average being 92, and the respiration from 20 to 40, average 31. The average temperature, pulse and respiration, therefore, were 98.2°—92—31. This is remarkably little variation from the normal for a condition so soon to show its lethal character and is a common cause of error for the unwary practitioner.

The leucocytes varied from 2900 to 25,750 per cu. mm., averaging 13,700. In the few fatal cases the count was below 10,000 in each, being respectively 4500, 4800, 9600 and 9600 cu. mm. The polynuclear percentages in these five cases were 53 per cent., 62 per cent., 78 per cent., and 77 per cent., respectively. It would seem, therefore, that a low leucocyte count with a low percentage of polynuclears is a bad diagnosis sign though exceptions occur, as shown by the remarkably low count of 2900 in a successful case and seven other cases in which the count was below 10,000.

Concerning the important factor of time elapsed before operation, the following table is explanatory:

Time Elapsed	1–6 hrs.	6–12 hrs.	12–24 hrs.	24–72.	Unknown.
Lived	25	12	5	4	6
Died	1	2	1	0	0

This table shows the ascending trend of mortality with the increase of elapsed time before operation, which has been so well emphasized by Moynihan, Caird, Walker and others. During this same period seven other patients with perforation were admitted to the hospital in a moribund condition and died without operation. Were these patients added to the above table the difference in mortality in the last group would be more striking and the combined medical and surgical mortality of the entire series of seventy-four patients would be twelve, or 16 per cent. It is not our practice either to refuse a chance to a patient or to waste the resources of surgery upon the dying, which we regard as a species of maltreatment to the patient that reacts upon surgery to its discredit. Nothing so impresses the lesson of the disastrous consequences of delay as refusal to operate and thereby cover the error.

The operations performed are as follows:

	Gastric Perforations			Duodenal Perforations		
	Recovered	Died	Mort. Per cent.	Recovered	Died	Mort. Per Cent.
Suture and post gastro-jejunostomy	9	1	11.1	33	2	6
Suture only	5	1	20	3	0	0
Pylorectomy	1	0	00	0	0	00

The appendix was removed in twenty-one cases and the gall-bladder in two. Both cases in which cholecystectomy was added recovered, as did all appendectomies except one. The appendix is frequently diseased in these cases, as is well known, and I observed, about a year ago, a fatal case of appendicitis which developed in a young man upon whom a successful operation for perforated duodenal ulcer had been performed by another surgeon some months previously.

A glance at these figures shows that there is no evident discrepancy in immediate results that could be attributed to the performance or non-performance of the primary gastrojejunostomy. The mortality of 20 per cent. in the group treated by suture only, as compared with 7 per cent. in the series where anastomosis was made, carries no conviction, because of the small number of cases treated by suture only and the further fact that four of these cases were so treated because they were obviously bad operative risks. The remaining five cases treated by suture only were operated upon by others in my service who were less inclined formerly to add gastro-enterostomy to suture. On the other hand, it must not be supposed that all forty-two recovered cases in whom gastroenterostomy and often appendectomy, and in two cases cholecystectomy, were added were first-class operative risks according to usual standards. They averaged about eight

hours from the time of perforation. They showed the typical clinical picture of acute perforation. The majority presented an extensive peritonitis with much fluid exudate. Often the perforation was large and there had been escape of food particles. The only characteristic in common that was remarked was that they behaved well on the operating table so far as respiration, aëration and circulation were concerned. It is a general rule that it is bad judgment in any operative procedure to prolong surgery after a patient shows signs of embarrassment of these vital functions. This applies to perforated ulcer surgery with equal force, but I cannot see that it has much bearing upon the advisability or inadvisability of primary gastro-enterostomy, for if anything can be demonstrated by experience such a series as this shows that the operation *can* be done with safety if the surgeon uses surgical judgment in selecting his cases, and, more than that, it demonstrates that the operation is practicable in the vast majority of cases.

That an operation is practicable is in itself no good and sufficient reason for doing it. Our reasons are that we believe it gives a lower primary mortality and a better outlook for the future.

Consider the following facts with respect to the immediate mortality which is the feature chiefly stressed by the opponents of primary gastro-enterostomy on the ground that it unduly prolongs the operation and spreads infection. Of the entire sixty-seven cases in the series fifty-five had the simultaneous anastomosis with three deaths, mortality 5.5 per cent. Of the twelve cases that had no gastroenterostomy, two died, mortality 17 per cent. But it may be urged that these series were selected in such a manner as to throw the heavier mortality in the latter group. In a measure this is true, but as we have no parallel series operated upon by simple closure let us take the results of those who are satisfied with the simpler procedure. Struthers reports the largest series, ninety cases with twenty deaths, a mortality of 22.2 per cent. The report is too brief to show definitely the type of operation in all cases, but Struthers in common with the Edinburgh School rejects gastroenterostomy as a primary operation, except for stenosis. Murphy in England reports twenty-eight cases of ruptured gastric ulcer in soldiers, treated by suture only, with two deaths: mortality 7.1 per cent. This is an excellent showing, but it must be remembered that he was operating upon a selected group of good physical subjects, and with very few exceptions his cases were brought to operation in the early hours after perforation. No end-results are given.

Gibson, in 1916, reported fourteen cases similarly treated with one death; mortality 7.1 per cent.

Walker reported from the Boston City Hospital ninety-eight cases with twenty-one deaths; mortality 26.9 per cent.; almost all these cases were treated by simple suture.

Alexander reported thirty cases with nine deaths, a general mortality of 30 per cent. Ten of these cases were treated by enterorrhaphy and posterior gastrojejunostomy without a death, the nine fatalities occurring in the cases treated by simple suture. In spite of this record, Alexander concludes that gastroenterostomy is unnecessary because he could see no differences in the after-results of the two types of operation in the fourteen cases followed.

Richardson reported ninety perforations in the Massachusetts General Hospital with thirty-two deaths; 35.5 per cent. mortality. Only twelve cases were subjected to primary gastroenterostomy, of whom two died; mortality 17 per cent. In spite of the lower mortality Richardson condemns primary gastroenterostomy, saying that these were selected cases. He then states that these two deaths were due in one case to diabetic coma and in the other to delirium tremens which somewhat impairs his statement as to selection.

Many other series may be instanced but no point would be served. To offset those who have had favorable runs of cases by simple closure I may say that at one time I had over thirty consecutive cases treated by closure plus primary gastroenterostomy without a death.

In short, we are certain that the mortality of acute perforated ulcer is not increased by simultaneous gastroenterostomy provided it is done quickly, and not attempted in cases obviously shocked. We have, moreover, a distinct impression that the operation has given a lower primary mortality not only in the hands of those who use it routinely, but with those who employ it only occasionally for more narrow indications, and then explain their lowered mortality by saying that it was done only in selected cases.

There has been much talk on the subjejct of the dangers of infecting the lesser peritoneal cavity by opening the transverse mesocolon for the performance of gastroenterostomy. But no one seems able to report a case in which there is good reason to believe that this has occurred, and moreover, as we pointed out years ago, and since verified by others, much of the exudate that is poured out so richly in these cases is in reality sterile or relatively so, being a response to the chemical irritation of the gastric and duodenal contents rather than the result of bacterial inflammation. In this series there were thirty-four cultures of the fluid in the peritoneal cavity which were sterile in twenty-three cases and positive in only eleven.

Another point which has always seemed strange to us is the denial by the antagonists of the operation that gastroenterostomy possesses either a favorable early or late influence upon those patients admittedly the subject of the disease for which gastroenterostomy is acknowledged to be the cornerstone in treatment. A surgeon whose mind works in this peculiar fashion would never think of operating upon an ulcer in the pre-perforative stage by simple suture without gastroenterostomy. Yet the moment a spontaneous perforation has occurred, however small or large and wherever

situated, he feels that the ulcer has now demonstrated that it is on the high road to recovery provided it has not succeeded in giving the patient a fatal peritonitis. Much has been said about the favorable influence of perforation *per se* upon the healing of ulcer. Gibson blandly and epigrammatically remarks that he "considered it unwise to do a gastroenterostomy for a condition which is going to be cured anyhow." While that may have been his experience in a small consecutive group of cases, and although many have been struck with the fact that ulcers treated by inversion often give no further trouble, it is now becoming clear that perforation in itself is not a guarantee of cure. Gibson's experience that all ulcers are cured by perforation and simple suture must be exceptional. We are unable to report the end-results in the entire series, as many of our cases belong to the class that are exceedingly hard to follow and our follow-up system, being of recent organization, has been unable to find many of them. However, we have records of the later condition of twenty-one patients (40 per cent.).

		End Results.	
	Good	Improved	Unimproved.
Suture only	2	0	2
Suture and posterior gastroenterostomy	17	0	0

Of the twenty-one cases only two were unimproved and these were both cases in whom gastroenterostomy was omitted. In one case suture only of a duodenal ulcer was made because of the bad condition of the patient. After recovery he still had indigestion and returned three months later for gastroenterostomy. He left the hospital symptomatically relieved and no further report is available. The second case was one of perforation of the anterior wall of the stomach, in good condition at the time of operation. He was operated upon by one of the assistant surgeons who omitted the gastroenterostomy. After recovery he had persistence of digestive troubles and two years later was readmitted for perforation of the posterior wall of the stomach. This was sutured and a posterior gastrojejunostomy made, since which time, eighteen months ago, he has remained well and without gastric symptoms. Lewisohn has recently reported five cases of recurrent or persistent ulcer after suture of spontaneous perforation. Alexander followed fourteen cases of whom seven had been treated by suture only and an equal number by suture and posterior gastroenterostomy. He found only one case entirely well and this was treated by suture only. This experience is at the opposite pole from Gibson's results, who reported that all his cases of simple suture had remained well. In all such studies it is well to remember that, even before perforation, ulcers may give no evidence of their presence or but the slightest symptoms in 20 per cent. of the cases, as in this series. Struthers reports 40 per cent. of his cases as having either no disturbance or only the mildest gastric troubles before perforation. It is not surprising, therefore, that many

ulcers after closure give little or no evidence of their presence even though unhealed. The base and edges have been put at rest by inversion. Rest, restriction in diet, and medication have exercised a favorable influence. It is quite probable that healing occurs in some cases. However, that healing is not the uniform result is shown by the cases already reported and by the experience of Sullivan, Taylor, Field, Wise and many others. Even Eliot, strong antagonist of primary gastroenterostomy, has collected seventy-five cases in which there was evidence of ulcer symptoms or later complications, such as hemorrhage or perforation, which might have been prevented by gastroenterostomy. We have learned, it is true, that gastroenterostomy is not always successful in relieving ulcer symptoms or in preventing complications, but we consider that it has been abundantly demonstrated that it is successful in such a high percentage of cases that there is no longer any doubt of its specific effect. The same arguments that are urged against gastroenterostomy in perforated ulcer may be urged and are urged by some of our medical colleagues against this operation in the treatment of chronic ulcer.

To our minds there are only two arguments of special and one of general nature that need be considered against primary gastroenterostomy. The general argument is one that has not been urged but should, nevertheless, be taken into account; namely, the liability to gastrojejunal ulcer. It would indeed be sad if a case that would have recovered entirely with suture only were to be subjected to gastroenterostomy and thereby acquire a gastrojejunal ulcer. If we were to generalize upon our own experience we might claim that this does not occur in the gastroenterostomy made for perforating ulcer, for we have had no such experience, but it is unsafe to draw deductions from the experience of a single series. Petrèn has reported such a case. The possibility is to be recognized but the incidence must be low. Unless it be considered a contraindication to gastroenterostomy for chronic ulcer it cannot be employed against the operation for perforating ulcer when the advantages are similar.

The weighty arguments of special nature are:

(1) That the mortality in unskilled hands will be increased by the addition of gastroenterostomy. (2) That even in the best hands gastroenterostomy will certainly raise the death-rate when used in desperately sick cases, whether early or late. To both these assertions we agree. Unless the surgeon is able to make the anastomosis quickly and with irreproachable technic simple suture is the safer operation. But let us not cloud the situation by pretending that the patient so treated as an emergency is as likely to remain free from ulcer symptoms or complications as if he had been given a gastroenterostomy as well.

Again, we repeat the statement made in the body of the paper, that it is not wise to insist upon making a gastroenterostomy in the presence of shock or evident systemic toxæmia. These cases are not numerous within

the first twelve hours after perforation, but they do exist. The importance of gastroenterostomy as a primary procedure is not so great as to warrant accepting obviously increased operative risk. That it does not increase the primary mortality in properly selected cases we consider to have been demonstrated. On the contrary, there is good reason to believe that it promotes convalescence and actually diminishes mortality. Accumulating statistics and more accurate follow-up records are dispelling the fallacy that perforation cures ulcer and tend to show that primary gastroenterostomy lessens the likelihood of future ulcer symptoms and complications.

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