TRANSACTIONS

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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

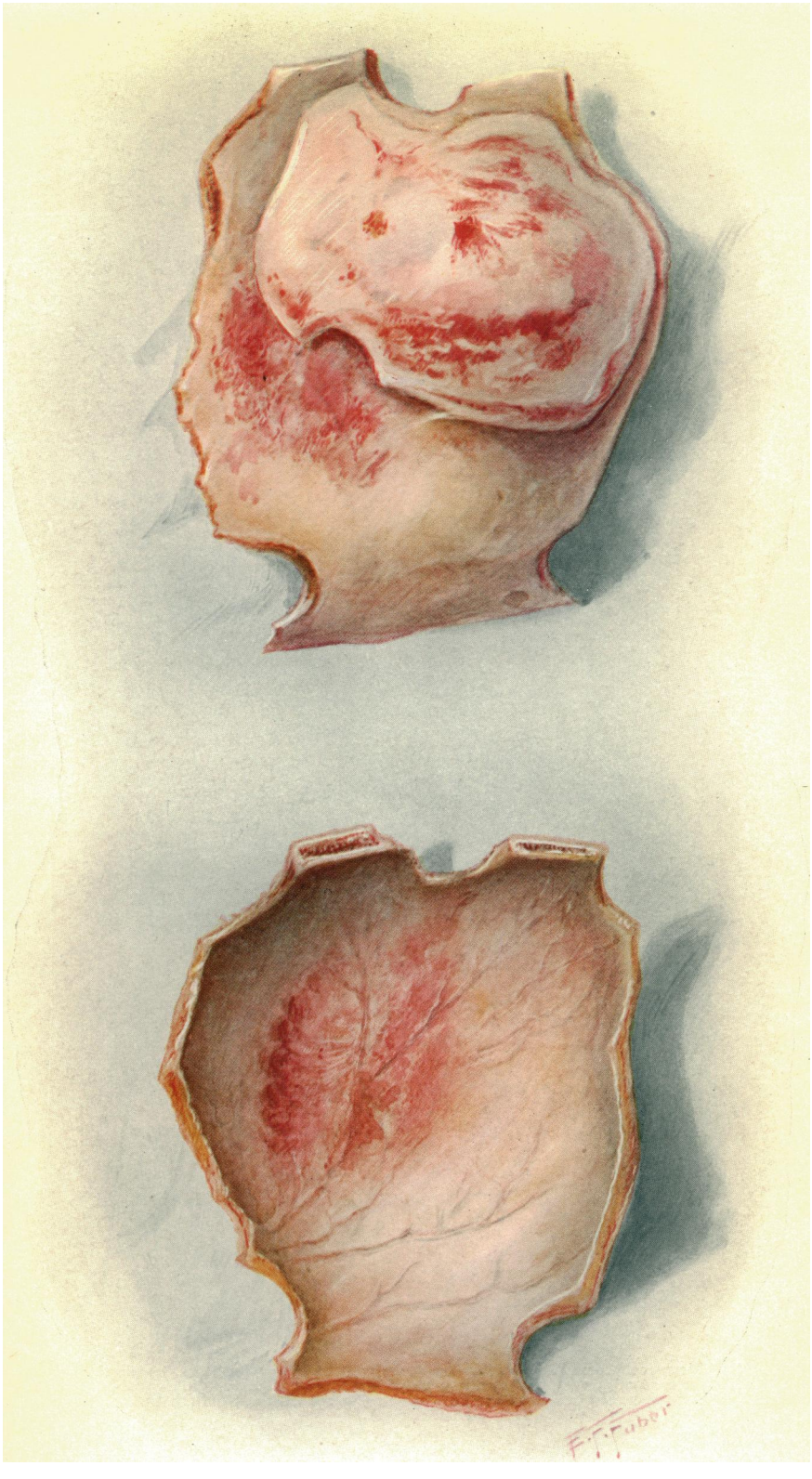


FIG. 1.—J. T., aged thirty-one years. P. E. H. January 6, 1920. Bone flap removed from right parietal region, and containing an exostosis (hyperostosis). Above, the outer surface of the bone, with the portion of the cranial aponeurosis excised because adherent to the exostosis. Below, the inner surface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

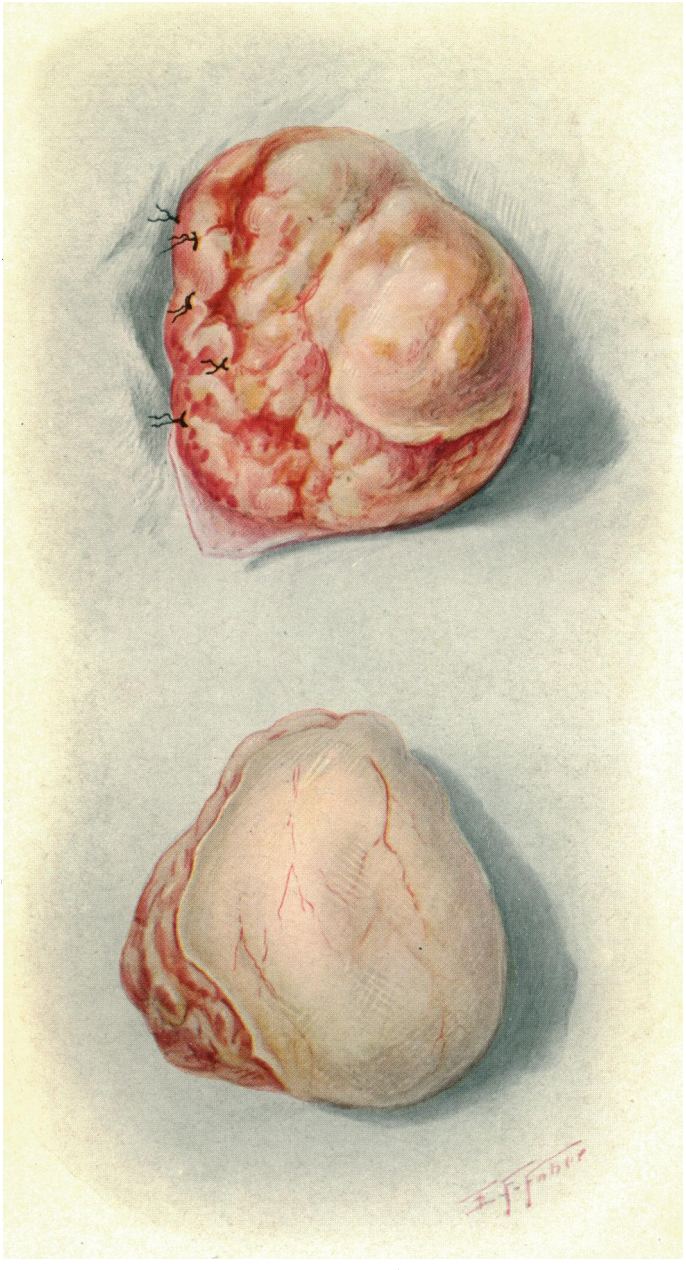


FIG. 2.—J. T., thirty-one years, P. E. H. January 6, 1920. Tumor growing from dura in right parietal region. Above, the cerebral surface of the growth, showing some of the ligatures in the region of greatest vascularity. Below, the cranial surface of the growth, showing the adherent dura excised with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

February 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 dam-

age 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 antitetanic 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.

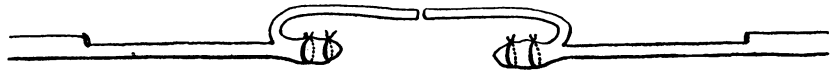


FIG. 5.—Neuroplasty of median nerve, to span a gap of 5 cm. Ligatures applied to prevent nerve ends from splitting beyond the bases of reflected flaps. Case of J. F., 52 years, P. E. H., October 21, 1916.

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

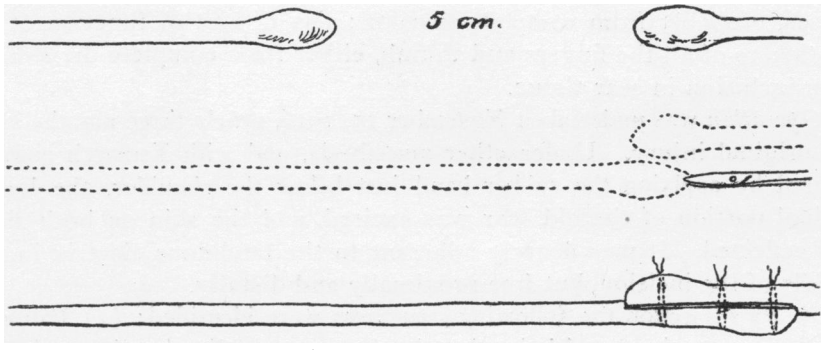


FIG. 6.—The bulbous end of nerve is caught in forceps and the nerve is stretched until the two ends overlap. They are then denuded on apposing surfaces, and united by lateral anastomosis. An actual gap of 5 cm. in the median and 3.25 cm. in the ulnar nerve was thus bridged. Case of W. B., aged eighteen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

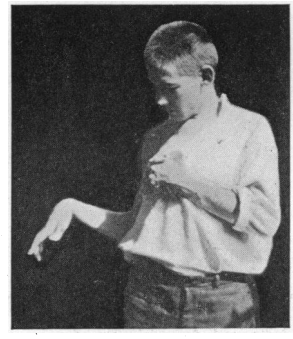
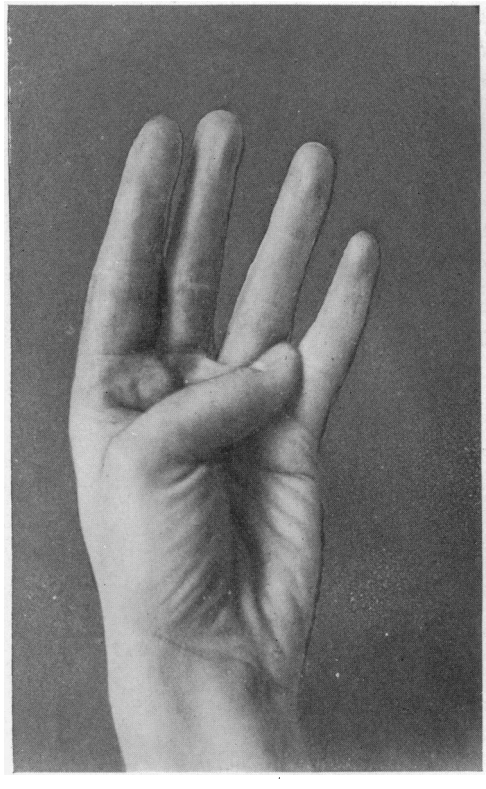
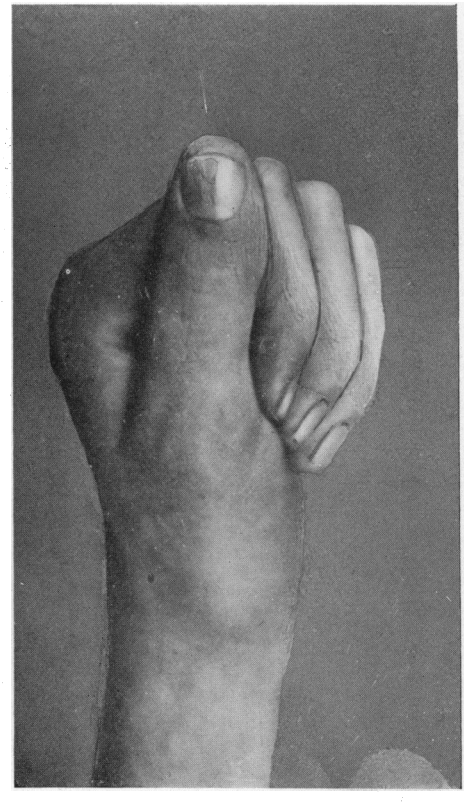


FIG. 4.—Case of hæmatomyelia three months after injury of cervical cord, showing residual paralysis. Episcopal Hospital.





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, M.D., 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) papilloedema 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.

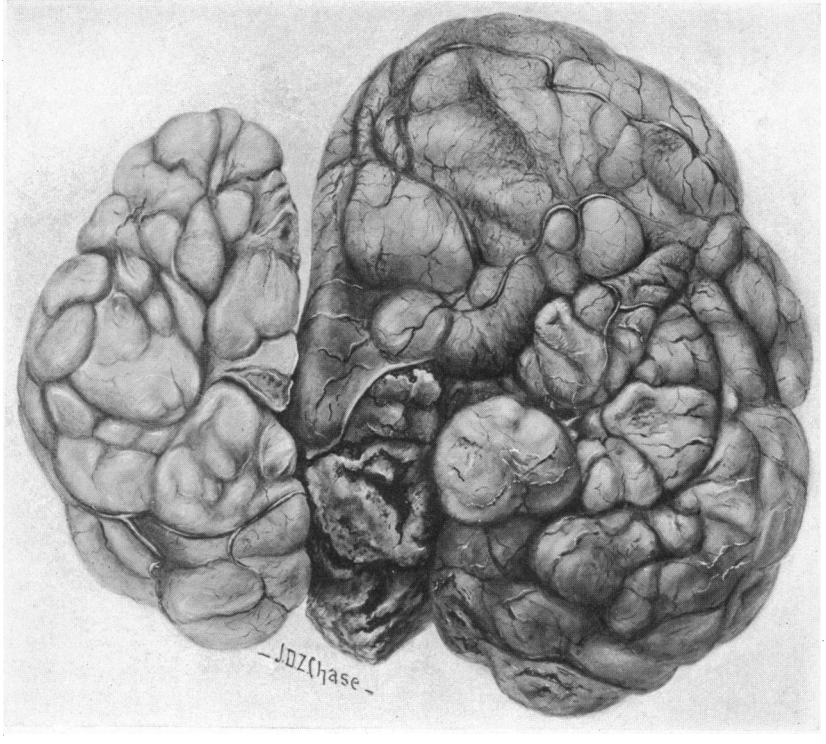


FIG. 1.—An endothelioma of the brain, composed of two sections apparently distinct, the one to the left measuring 7.5 x 4 x 3 cm. and that to the right 10 x 10.5 x 4.5 cm. The surface markings resembled somewhat the cortical convolutions and its capsule a pial membrane.

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. John H. Jopson read a paper with the above title.

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 333.

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 155, August, 1920.

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.

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