

shown to be free from typhoid bacilli will nearly always prove not to be a case of typhoid fever.

9. The results in relapses are the same as those in the primary attacks. The bacillemia in the relapses is due to a new invasion.

10. We cannot draw any definite conclusion, as yet, concerning the value of the blood cultures in determining the prognosis.

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THE UNCERTAIN RESULTS OF SUTURING NERVES.

By GEORGE TULLY VAUGHAN, M.D.,

PROFESSOR OF SURGERY IN THE GEORGETOWN UNIVERSITY, WASHINGTON, D. C.

WHEN one reads the reports of the numerous cases of nerve suture and observes the small percentage of successful results, he is forced to conclude either that the repair of nerves is uncertain and erratic, or that the technique of such operations is far from satisfactory. There certainly seems to be a difference in the ability of different nerves to regenerate. Contrast, for example, the perverse persistence of the trifacial in reproducing itself after the removal of segments as much as one inch in length with the obstinate resistance to reunion or regeneration of the median or ulnar nerve after it has been carefully sutured together and apparently placed in the most favorable condition for repair.

Whether regeneration of nerves occurs as an outgrowth from the neuron or central nerve cell, according to Waller, Ranvier, His, Waldeyer, and others, or whether, according to Bethe, Nissl, Dohm, Ballance and Stewart, and Tizzoni and Cattani, the regeneration is the result of proliferation of the cells in the sheath of Schwann, is a matter which has not been decided, but the latter theory seems to be gaining ground.

It is generally thought that immediate suture of a divided nerve is more likely to be successful than secondary suture, but this seems to be a matter of no importance, according to Bowlby.¹ Thus, in 81 cases of primary nerve suture there were 32 successful results, 34 partially successful, and 14 failures, while in 73 cases of secondary nerve suture there were 32 successful results, 26 partially successful, and 15 failures—the primary suture giving 39 per cent. of successes and the secondary 43 per cent. of successes. Powers² reviews 22 cases of nerve grafting in which a segment of a nerve from a dog or

¹ An American Text-book of Surgery.

² Trans. Amer. Surg. Assoc., 1904.

from some other source was transplanted between the two ends of a severed nerve, with 3 "good" results and 3 "fair" results, 27 per cent. being more or less successful, although Powers says, "Ooe is forced to question the authenticity of some of the results accounted 'satisfactory,'" and concludes by expressing the opinion that nerve transplantation should be discarded. Powers reviews also 11 cases of flap operations, in which a flap was turned down from one or both ends in order to bridge the gap, with 4 complete or partial successes, 2 failures, and 5 discarded as having been reported too early or as lacking in detail; 10 cases of implantation or anastomosis, in which one nerve was implanted into another, with about 50 per cent. of "encouraging" results; 7 cases of bone resection, but does not give results; 5 cases of suture à distance, with encouraging results; and one case of tubulization.

Murphy³ gives the following: Implantation for poliomyelitis, 11 cases, 1 success, 6 improvements, 1 failure, 3 too early to know the result; for facial paralysis, 33 cases (including 2 of tic convulsif); 21 of faciospinal-accessory and 12 of faciohypoglossal, with 7 successes, 15 improvements, 5 failures, 1 lost sight of, 1 indefinite, 4 too recent to give definite result, but some had improved. Seven had associated movements of the shoulder or tongue. Of the 7 successful cases, 5 were faciospinal-accessory and 2 were faciohypoglossal.

Of operations for rupture of the brachial plexus, A. S. Taylor⁴ reports 9 cases with 1 death, and improvement in some cases; but he does not state in how many or to what extent.

Thus, it is seen that the percentage of successes is small even in a large number of operations. It is true that some of the cases were reported too early to know what the final results would be, but this may be offset by the number of eventual failures which are never reported—the inducement to publish failures not being very great.

CASE I.—Wound by a saw dividing the radius, the median and the radial nerves, and most of the tendons of the wrist; suture of the divided structures.

C. D., a white boy, aged fifteen years, was admitted to the Emergency Hospital, March 30, 1898, on account of a wound received the day before by a circular saw striking the right forearm just above the wrist. The wound had been temporarily closed and the patient was sent to the hospital for the purpose of having the hand amputated.

On opening the wound and examining the parts, the following conditions were found: Fracture of the radius about 2 inches above the wrist-joint and division of the median and radial nerves, the radial artery, and the tendons of the flexor carpi radialis, palmaris longus, flexor sublimis digitorum, part of the flexor profundus

³ Surgery, Gynecology, and Obstetrics, April, 1907.

⁴ Jour. Amer. Med. Assoc., January 12, 1907.

digitorum, the flexor longus pollicis, the extensor ossis metacarpi pollicis, extensor primi internodii pollicis, extensor secundi internodii pollicis, supinator longus, extensor carpi radialis longior, and extensor carpi radialis hrevior. The median nerve was carefully united with fine silk, using through and through sutures, and all the divided structures except the radial nerve and the flexor longus pollicis were united, although it was not certain that in every case the two ends which were united were those which belonged together. The wound suppurated but finally healed, and the patient seemed to be getting pretty good use of his hand at the end of about two months, when he disappeared, and was next seen April 13, 1906, eight years after the injury. A large scar is seen above the wrist, which is exquisitely tender over the middle of the anterior surface. The hand is slightly flexed at the wrist and slightly deviated toward the ulnar side. He has good use and sensation of all the fingers except the index finger and thumb, which are numb to pin pricks on both dorsal and palmar surfaces; cannot flex the index finger or thumb, but can hold objects between the index finger and thumb by a curious trick—he catches the index with the middle finger and brings it down against the thumb; cannot appose thumb to fingers. It is a good useful hand for rough work, although it is evident that the median nerve is still ununited and one end is probably indicated by the tender point in the scar. The patient is not willing to have another operation to free the median nerve from the scar in which it seems to be embedded.

CASE II.—Gunshot wound of the right arm, severing the median nerve, brachial artery, basilic vein, and the biceps and coracobrachialis muscles; nerve sutured.

October 19, 1902, N. E. M., a white male, aged thirty-four years, a clerk, was admitted to Georgetown University Hospital, having just been wounded while holding a gun in his hand, the load of birdshot passing through the right arm just below the middle and dividing the median nerve, the brachial artery and veins, the basilic vein, and the biceps and coracobrachialis muscles. The ulnar nerve was stripped bare for a space of two or two and one-half inches, but did not seem to be wounded. There was little hemorrhage, the ends of the brachial artery being filled with coagula.

The ends of the median nerve were united with two silk sutures at right angles to one another, passing entirely through the nerve, the muscles were sewed together with catgut, and the brachial artery ligated with catgut. For a month there was almost complete paralysis of the flexor muscles of the hand, showing that the ulnar nerve had suffered from contusion or concussion.

The bone had been injured by the shot, and a sinus formed which discharged pus several months before healing. It took the patient more than six months to recover the use of the muscles supplied by the ulnar nerve, and he has never recovered the use of those supplied

by the median nerve. Examined July 29, 1904, more than eighteen months after the injury, the following notes were made: Sensation seems normal to pin prick except over back of last phalanx of middle finger; pronation and supination normal; good strong flexion and extension of the three inner fingers, but not quite perfect, the last phalanges not being completely flexed nor completely extended. The index finger is capable of only about half flexion, and the thumb can be flexed only to a very slight degree and cannot be opposed to the other fingers. Still the patient has good use of the hand as salesman in a shoe store, and is unwilling to have another operation for the purpose of improving the condition of the hand.

Evidently in this patient the median nerve has not united, or, if so, the point of union is occupied by scar tissue which interrupts the continuity of the axis cylinders.

The patient was again examined September 5, 1907, and his condition was found to be unchanged.

CASE III.—Gunshot wound of the left arm, dividing the median nerve and the brachial artery; flap method used in suturing the nerve.

F. W., a colored male, aged sixteen years, was admitted to the Emergency Hospital June 7, 1904, on account of a gunshot wound received the day before. The charge of small shot from the gun, almost touching the patient's body, passed along the left side, tearing the flesh from the seventh, eighth, and ninth ribs, opening the pleural cavity, then striking the left arm on the inner side about midway between the elbow and shoulder, it passed upward and backward, to emerge posteriorly about one and one-half inches above the wound of entrance.

The patient's condition did not justify the operation for suturing the nerves until July 2, four weeks after the receipt of the wound. From the symptoms it was assumed that the median nerve and brachial artery had been divided. There was inability to close the fingers completely, the thumb and index finger could not be flexed at all, the three other fingers could be flexed partially, the little finger almost perfectly, the ring finger not quite so well, and the middle finger still less. After closing the fingers he had difficulty in extending them. Sensation seemed unimpaired except over the last two phalanges of the middle finger, both dorsal and palmar surfaces. Pronation and supination were possible, and the patient could touch the tip of the middle finger with that of the thumb, but none of the others. While resting quietly the left index finger lay straight, with almost continual successive contractions of the extensor tendon.

Under ether the wound in the arm, partially cicatrized, was enlarged, exposing the lower segment of the median nerve, which was in its normal position by the side of the obliterated brachial artery. After a little search the upper segment was found pointing backward and lying in the upper part of the wound of exit. The two segments could not be approximated—at least an inch of the nerve had been

destroyed. A flap was cut from the upper segment, turned down, and sewed end-to-end to the lower segment with silk—one through and through suture and several in the neurilemma. The other nerves showed no sign of injury.

The wound healed and the patient left the hospital before any change had taken place in the hand.

November 20, 1907. Beyond slight numbness in the thumb and first two fingers, the result is perfect. Flexion and extension, apposition of the thumb to the tips of the fingers, pronation and supination, all are normal. The radial pulse is about as strong in the left wrist as in the right.

There is a suppurating sinus leading to the left pleural cavity. After leaving the hospital, while the wound in the side was still discharging, the physician one day while probing the wound removed from its interior a one-dollar bill, which had been carried from the patient's pocket into the tissues by the charge from the gun.

CASE IV.—*Wound with broken glass dividing the median nerve and several tendons in the wrist; suture of the divided structures.*

A. C., a white female, aged six years, was admitted to Georgetown University Hospital, December 31, 1904, having just had her right wrist cut with broken glass. Examination showed an oblique, clean-cut wound across the anterior surface of the wrist joint, not reaching quite across the radial side, from which the end of a tendon protruded. The patient was asked to flex the fingers, and at first said she could not do it, but finally did so, slowly flexing the four fingers until their tips touched the palm, but the second and third phalanges were not well flexed. Other tests could not be satisfactorily made, as the child was frightened.

Under chloroform it was found that the median nerve, all four tendons of the flexor sublimis digitorum, and the flexor profundus digitorum had been completely divided, while the flexor carpi radialis had been partially divided. The upper ends of the tendons had retracted from half to one inch and were found by splitting the skin and fascia from the wound upward. All were united, using the same kind of suture for nerve and tendons—silk through and through—and other sutures for the sheath. Profuse suppuration followed, but the wound healed in about four weeks.

Examination March 3, two months and three days after the injury: flexion of fingers about the same, second and third phalanges do not flex completely; most marked in the index finger. The thumb can be approximated to the other fingers with some difficulty, which is greatest with the little finger. There is some numbness of the thumb, index, and middle fingers.

The patient was again examined March 31, 1907, two years and three months after the injury, and the hand was found perfectly normal.

In this patient the flexion of the first phalanges by the interossei

muscles, which are supplied by the ulnar nerve, was beautifully shown, as, although both flexor tendons were completely divided, the patient could still close the fingers, it is true in a loose sort of way, but a careless observer would probably have concluded that the flexor tendons had not been injured.

The ability to approximate the thumb to the fingers must be explained, it seems to me, on the ground that the adductors and part of the short flexor of the thumb, which are supplied by the ulnar nerve, act to some extent for the opponens pollicis, but that such substitution does not always take place is shown by the result in the second case reported.

CASE V.—Saw wound of the axilla dividing the axillary vessels and the median, ulnar, musculospiral, and internal cutaneous nerves; suture of the nerves; gangrene; amputation below the elbow.

A. S., a white male, aged eighteen years, was admitted to the Emergency Hospital July 7, 1907, having the day before been thrown against a circular saw. Examination showed a large ragged wound of the right axilla and right side of the chest, extending to, and grooving the neck of, the humerus and dividing the pectoralis major, the axillary vessels, and the median, ulnar, musculospiral, internal cutaneous, and lesser internal cutaneous nerves. The vessels had been closed by the formation of thrombi. The nerves were united after considerable difficulty in finding the ends and determining which ends belonged together, using silk and overlapping the ends.

The lower ends of the median and musculospiral nerves were concealed several inches below the wound, and dissection of the arm below the wound was necessary in order to find them. The wound was partially closed and drainage provided. Next day the hand was cool, and slight gangrene of the edge of the wound was noticed.

July 16, a line of demarcation had formed about the middle of the forearm, so that the forearm was amputated about three inches below the elbow. Recovery followed, but it is too early to expect any restoration of function in the muscles supplied by the sutured nerves.

THE PATHOGENESIS OF TABES DORSALIS.¹

BY TOM A. WILLIAMS, M.B., C.M. EDIN.,
OF WASHINGTON, D. C.

THE pathogenesis of tabes dorsalis has excited a great deal of discussion ever since Duchenne² first differentiated the locomotor

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² Arch. de méd., 1858.