

curative measure. Sprays with an oil of low specific gravity (0.850) are of special benefit in autumnal hay-fever, as the oil softens the spicules of the pollen and diminishes their irritation. Menthol and other drugs in this oil are to be avoided, as they are of little benefit and limit the free use of the oily spray.

Reduction of Infected Area.—The cutting of the weeds in the neighborhood of the patient's residence is of the first importance. In a neighborhood in New Orleans, the cutting of the weeds in one neglected square resulted in four known hay-fever patients in this immediate neighborhood being entirely without hay-fever the following season.

In the treatment of hay-fever, the patient is first given a glycerin plate to collect the infecting pollen for identification, and to determine whether it is spiculated or unspiculated. An inspector is then sent who makes a "thirty-six square inspection," which includes three squares in each direction from the residence of the patient. In most cases examined thus far, the infecting weeds were found in this survey. The lots having neglected grass and weeds are then reported to the health officer, who files affidavits for violations of the grassweeds ordinance.

These suggestions regarding treatment have given uniform satisfactory results, a full report of which will be given at the end of the season.

CONCLUSIONS

There are two forms of pollen causing hay-fever, the first, spiculated in form and low in protein, causing direct hay-fever; the second, unspiculated in form and high in protein, causing hay-fever by absorption of the protein (indirect hay-fever).

In direct hay-fever, the severity of the attack and its duration depend on the number of pollen grains in the atmosphere, and the length of the pollen spicules. The ragweeds form the type and the principal cause of this form of hay-fever.

In indirect hay-fever the severity of the attack and its duration depend on the amount of protein contained in the pollen and on the number in the atmosphere. The grass pollens have the highest percentage of protein, and form the type and the principal cause of this form of hay-fever.

Pollens without spicules and with an inappreciable amount of protein are innocuous in hay-fever.

The Field of Chemistry.—Modern chemistry has had a manifold origin and tends toward a many-sided destiny. Into the fabric of this science men have woven the thought of ancient Greek philosophers, the magic of Arabian alchemists, the practical discoveries of artisans and ingenious chemical experimenters, the doctrine of physicists, the stern and uncompromising logic of mathematicians, and the vision of metaphysical dreamers seeking to grasp truths far beyond the reach of mortal sense. The complex fabric enfolds the earth—indeed, the universe—with its far-reaching threads.—T. W. Richards, *Ideals of Chemical Investigation*.

BRACHIAL PLEXUS SURGERY*

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MINNEAPOLIS

The present European war, with its colossal total of wounds, many of which inevitably involve the peripheral nerves, has aroused an added interest and stimulated additional research in the surgery of this system.

Brachial plexus injuries in the adult, aside from those resulting from gunshot or stab wounds, or secondary to skeletal injuries, are rare, as was shown in 1911 by Frazier and Skillern,¹ who were able to collect reports of only twenty-one cases which had been verified by operation. Anatomically the brachial plexus, located almost subcutaneously in the root of the neck and unprotected by the skeleton, is vulnerable to direct injury. Direct trauma used to be considered the most frequent cause of injury to these nerves until experimentation by Horsley² and Taylor,³ and a closer study of etiologic mechanics convinced observers that injury of the plexus did not frequently result from pinching them between the clavicle and first rib, but rather from their forcible avulsion, which tore the cords out by the roots, in the intravertebral and intervertebral cases, and ruptured them anywhere between the spine and axilla in the supraclavicular or infraclavicular types.

The relatively large number of so-called cases of "birth palsies" in infants, which at present are being reported, lend confirmatory evidence that avulsion of the

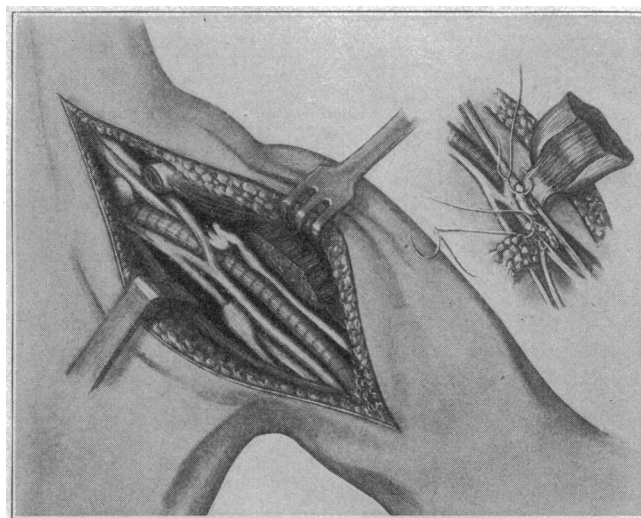


Fig. 1 (Case 1).—Avulsion of musculocutaneous and musculospiral nerves. Inset shows end-to-end and end-to-side or crossed anastomosis.

brachial plexus trunks comes from indirect violence, for here the upper cords of the plexus are torn asunder or out of the foramina themselves, by extreme traction of the shoulder away from the head in the birth of the child. When the lower cords are injured, this results from breech presentations in which the arm is stretched up over the shoulder and the lower cords are put severely on the stretch, probably over the head of the humerus. Again, there are the reported cases in adults when heavy objects like trees or timbers fall on the shoulder and pull it away from the neck, as in Murphy's case;⁴ or when men are thrown onto their shoulders, violently separating the neck from the shoulder as in Peck's case;⁵ or in falling from a height and clutching at something to break their fall, their arm is violently abducted and

* Read before the Section on Surgery, General and Abdominal, at the Sixty-Seventh Annual Session of the American Medical Association, Detroit, June, 1916.

1. Frazier, C. H., and Skillern, P. G.: Supraclavicular Subcutaneous Lesions of the Brachial Plexus Not Associated with Skeletal Injuries. *THE JOURNAL A. M. A.*, Dec. 16, 1911, p. 1957.

2. Horsley, Sir Victor: *Practitioner*, London, 1899, lxxiii, 136.

3. Taylor, R. W.: *Med. News*, 1905, lxxxvi, 1013.

4. Murphy, J. B.: *Surgical Clinics*, 1912, i, 339.

5. Peck: *Ann. Surg.*, 1911, liii, 858.

pulled above the head, as reported by Brislow;⁶ or, as happened in both of my cases, the patient's arms are caught in belts and they are pulled into and whipped forcibly over pulleys, the arms being jerked away from the bodies, and in one instance the man being thrown heavily against a post, striking on the root of his neck. All of this accumulated evidence disproves the theory of direct violence.

Successful surgery of the brachial plexus, as of any of the peripheral nerves, is dependent on the application of our present day relatively exact knowledge of the phenomena of regeneration in the peripheral segments of severed spinal nerves, which occurs when that segment is united to the viable central segment, and furthermore on an appreciation of the property which nonmedullated neuraxons have of projecting themselves through space and reaching across a gap separating the severed nerve stumps, when properly guided and conducted by some method of tubulization, preferably of fascia, as in my⁷ case in which the musculospiral nerve completely regenerated across a space of 3 inches through a fascia lata tube. Lewis⁸ recently reported observations as to how the non-medullated neuraxons are conducted by and follow protoplasmic bands, which span this gap and originate from both stumps, are added evidence which opens up a fascinating realm of surgical opportunity and offers relief in the class of cases which have heretofore been considered hopeless.

After the severance of a nerve, both stumps undergo neuromatous degeneration, and scar tissue infiltrates the retracted clubbed ends and for a greater or less distance invades the nerve trunks. Serial sections of these clubbed ends ultimately expose the brush ends of the nerve fibers. If, then, these exposed and cleanly cut across fibers are approximated end to end and protected from the ingrowth of connective tissue by wrapping the union with a fascial or fat flap, we expect complete regeneration of the peripheral nerve, provided the central ganglionic cells are intact.

It is illuminating to know that it is entirely possible to make one highly specialized motor nerve carry impulses to a paralyzed group of muscles served by another injured or degenerated nerve, provided the paralyzed peripheral nerve segment is anastomosed with the proximal segment of the healthy nerve. This restoration of function is possible through a reeducation of the cortical centers (adjacent to or remote from one another) which enables them to meet the needs and respond to the peripheral necessity. Much research by many observers has clinched the conviction that this reeducation is entirely feasible, as is shown in the observations of Flourens⁹ on the crossed anastomosis of the brachial plexus in cocks, those of Rawa¹⁰ on cats,

and of Kennedy¹¹ and Murphy¹² on dogs, most of these observers reporting practically perfect results. Schiff¹³ crossed the hypoglossal and vagus nerves and found return of motion in the muscles of the tongue. In the experimental surgical laboratory of the University of Minnesota, Dr. Corbett and I cross anastomosed the various nerves of the brachial plexus in five dogs, wrapping the line of union with fascial flaps or vein cuffs. So perfect was the reeducation that at the end of five months it was difficult to determine which side had been operated on.

The clinical application of these laboratory findings has yielded excellent results, as demonstrated by the spinofacial and spinohypoglossal anastomoses, as originally suggested by Ballance and Stewart,¹⁴ and carried out so successfully by Cushing¹⁵ and other surgeons. Here restoration of function of the muscles of facial expression is more or less perfectly accomplished by reeducation of the brain centers; until that occurs and sometimes permanently, associated movements of the shoulder and face or of the face and tongue persist. Grant's¹⁶ remarkable result following spinofacial anastomosis, with the attendant anastomosis of the distal accessory fragment to the descendens hypoglossi, opened a new field of endeavor, for here the motor nerves arising from the first and second cervicals and running in the sheath of the hypoglossal with their centers, were reeducated to control the trapezius and do away with associated shoulder and face movements.

The success of these anastomoses and the reported success of the anastomosis between the anterior tibial and musculocutaneous nerves by Spiller and Frazier¹⁷ and Young,¹⁸ and between the external and internal popliteal by Murphy¹⁹ and Kader²⁰ in cases of infantile paralysis, give more than enough evidence to warrant the expectation of more or less perfect restoration of function, whether the nerves crossed be a part of the brachial or lumbar plexus or any of the peripheral nerves of highly specialized function.

Nerves which are forcibly avulsed are injured in a vastly different manner than those which are deliberately or accidentally cut cleanly across by a sharp instrument. In the avulsed trunks the bundles of neuraxons are torn at different levels and are frayed and pulled apart and severely traumatized, the endoneurial blood vessels are torn, hemorrhage occurs in the sheath, and this with the trauma of the accident and the hemorrhage about the nerves results in the

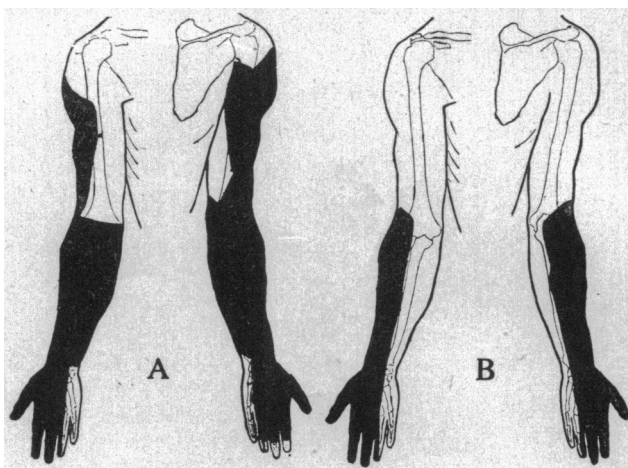


Fig. 2 (Case 1).—Dark areas indicate extent of anesthesia: A, before operation, and B, thirteen months later.

6. Brislow, A. F.: *Ann. Surg.*, 1902, xxxvi, 411.
7. Law, A. A.: *Some Modern Phases of Neural Surgery*, St. Paul Med. Jour., September, 1915.
8. Lewis, Dean: *Tr. Am. Surg. Assn.*, May 9, 1916.
9. Flourens: *Recherches expérimentales sur les fonctions du système nerveux*, 1824, p. 272.
10. Rawa: *Arch. f. Physiol.*, 1864, p. 421.

11. Kennedy, Robert: *Phil. Tr. Roy. Soc. London*, 1901, Series B, cxiv, 127.
12. Murphy, J. B.: *Surg., Gynec. and Obst.*, 1907, iv, 454.
13. Schiff: *Arch. d. sc. phys. et nat.*, Geneva, 1885.
14. Ballance and Stewart: *Brit. Med. Jour.*, May, 1903.
15. Cushing, Harvey: *Ann. Surg.*, May, 1903.
16. Grant, W. W.: *Traumatic Facial Paralysis*, *THE JOURNAL A. M. A.*, Oct. 22, 1910, p. 1438.
17. Spiller, W. G., and Frazier, C. H.: *The Treatment of Acute Anterior Poliomyelitis by Nerve Transplantation*, *THE JOURNAL A. M. A.*, Jan. 21, 1905, p. 169.
18. Young, J. K.: *Internat. Clin.*, iv, Series 14, p. 154.
19. Murphy, J. B.: *Surg., Gynec. and Obst.*, 1907, iv, 470.
20. Kader: *Chirurgical état actuel de la chirurgie nerveuse*, ii, 202.

secondary formation of scar tissue, either in the nerve sheaths themselves or about them. Later, scar contraction results in multiple neuromatous nodules of the trunks, which prevents the projection of the proximal axones into the distal segments, or the contraction of the perineural connective tissue strangulates the fibers to the extent of partially or wholly interfering with conduction, which inevitably is followed by trophic changes and motor and sensory paralysis.

One type of injury or neuritis which has been thoroughly studied by surgeons and neurologists is that caused by pressure on the lower cords of the brachial plexus by supernumerary ribs. This results in a pinching of the nerves in the angle formed by the scalenus anticus muscle and the cervical rib, this pinching being accentuated by the constant hammering from respiratory movements. A phase of this type of injury which seems to have escaped attention is caused, not by an adventitious rib, but by a supernumerary band or ligament taking the place of the rib and springing from the seventh cervical transverse process, projected forward and inserted either into the first rib with the scalenus anticus, as occurred in one of my cases, or into the interclavicular ligament, as happened in the other.

In both of my cases at operation, accessory ribs were absent. The seventh cervical transverse processes, however, seemed in the roentgenograms to be drawn down closer to the first dorsal transverse process on the affected side. In both instances these ligaments were extremely taut, and tightly stretched over them and sharply angulated were the eighth cervical and first dorsal

cords of the brachial plexus, the tension on which was immediately relieved when the ligaments were cut. This condition gave the typical peripheral symptoms in the hand, which are so characteristic of cervical ribs and the coincident brachial neuritis. In one of these cases, the trophic changes in the phalanges of the middle finger on the affected side were interesting to note. Comparative roentgenograms of both hands showed marked rarefaction of these bones, which was apparently identical with the picture of disuse atrophy.

Symptoms of brachial plexus injury or rupture are of course dependent on where the cords are injured. In the upper arm or "Erb-Duchenne" type, this injury generally occurs to the fifth and sixth branches proximal to the origin of the suprascapular nerve, and therefore the supraspinatus and infraspinatus are paralyzed. The characteristic atrophy of these muscles occurs along with inward rotation of the shoulder and arm until the hand and forearm is in extreme pronation. Winging of the scapula when the arm is held horizontal and pushed on is shown when the injury is high enough to be above the origin of the long thoracic nerve, and is caused by paralysis of the serratus magnus muscle. Coincident with the paralysis of the

shoulder girdle may be paralysis over the distribution of the posterior cord arising from the seventh cervical with branches from the fifth and sixth. Here, of course, the deltoid, biceps, coracobrachialis, triceps, brachialis anticus, supinators of the forearm and extensors of the wrist and fingers may be involved.

In the "Klumpke" or lower arm type, the eighth cervical and first dorsal branches are involved, and the symptoms are manifested in the areas supplied by the median ulnar, cutaneous and lesser internal cutaneous nerves, while the enervation to the upper arm and shoulder may be intact. This type is more uncommon than the former, and is liable to be accompanied by injury to the sympathetic system owing to loss of the celiospinal fibers which join it, coming from the first and second dorsal nerves and occasionally from the eighth cervical.

Injury to these fibers results in a typical series of symptoms, namely, narrowing of the palpebral fissure, or pseudoptosis, from paralysis of the nonstriated muscle fibers of Muller²¹ in the upper lid, and enophthalmos, or sinking of the eye from paralysis of the nonstriated microscopic muscle fibers, described by Landstrom,²² which are found in the fascia behind the eyeball and attached to the capsule of Tenon; also a contraction of the pupil on that side due to predominance of the motor oculus. Anhidrosis of this side of the face and neck may be observed from loss of sympathetic control of the sweat glands. These symptoms are generally an indication of an intradural avulsion.

In the cases in which all the cords have been avulsed high within the dura

or foramina, the persistence of sensation on the inner side of the upper arm is explained by the loops of communication between the nerves of Wrisberg and the intercostohumerals with the first, second and third intercostal nerves, which cannot be injured by avulsion.

In addition to the twenty-one cases of avulsion in adults verified by operation and collected up to 1911, we have found two other cases reported by Hartwell²³ and Murphy.⁴ These with my own two cases with operation swell the total to twenty-five. These injuries in adults are so rare that it is not given to any one surgeon to see a large series. Therefore I am constrained to report my cases somewhat in detail:

REPORT OF CASES

CASE 1.—G. H., man, aged 23, Dec. 5, 1914, while working in a flour mill, got his left arm caught in a large belt which picked him up and whipped him over a pulley before he was thrown off. This injury resulted in an immediate paralysis of all extensors of fingers and wrist, and of the supinators and the triceps. The biceps, coracobrachialis and brachialis anticus were paralyzed as well. Anesthesia existed on the

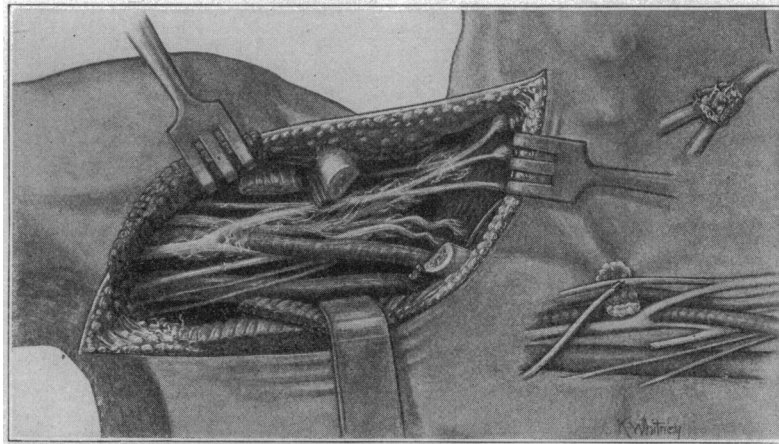


Fig. 3 (Case 2).—Avulsed nerves of brachial plexus, neuromatous nodules and scar tissue about plexus. Insets show transposition, suture and wrapping of the line of union with free fascial flaps.

21. Muller: *Ztschr. f. Zool.*, 1858; *Worzb. Verhandl.*, 1859.

22. Landstrom: *Ueber Morbus Basedowii*, 1907.

23. Hartwell, J. A.: *Ann. Surg.*, 1914, ix, 516.

anterior and posterior aspects of the upper arm from the middle of the deltoid to and including the elbow and over all of the forearm and hand, save on the ulnar side of the hand from the midline of the ring finger, front and back, and extending up to the wrist. There was sensation over the first phalanges of the first, second and third fingers on the dorsum. There was sensation on the inner side of the upper arm, beginning 2 inches above the elbow. The shoulder girdle was intact with the exception of the deltoid, which was

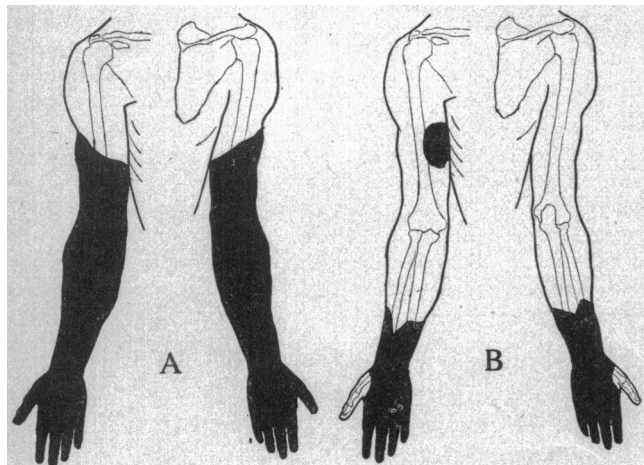


Fig. 4 (Case 2).—Dark areas indicate anesthesia: A, before operation, and B, four months later.

paralyzed. This injury, then, was of the mixed type, and obviously involved the musculocutaneous below the outer head of the median, and the musculospiral above the origin of the circumflex.

There were no symptoms of sympathetic involvement, and all the muscles involved showed the reaction of degeneration prior to operation. April 29, 1915, or four and one-half months after the injury, the clavicle was sawed in two and an anatomic dissection of the brachial plexus made. This revealed a tortuous neuromatous scar of the musculocutaneous nerve, beginning just distal to the outer head of the median. The proximal stump of the musculospiral could not be recognized, and the distal stump was clubbed and retracted 3 inches from its normal origin. All other cords and their branches, save the musculocutaneous and musculospiral, responded normally to a faradic exciter. The neuroma of the musculocutaneous was resected by serial sections for 3 cm. until the normal fasciculi of both stumps were determined, when the stumps were approximated with fine chromic gut sutures. The line of union was then wrapped with a pedicled fascial flap from the stump of the pectoralis major. The clubbed distal end of the musculospiral was resected and this nerve implanted by end-to-side anastomosis into a slit in the side of the median nerve and anchored there with chromic gut, the line of union being wrapped with a pedicled flap of axillary fat. The sectioned clavicle was drilled and united with kangaroo tendon.

Now, thirteen months later, by reeducation, this man has nearly a normal return of all of the functions of the deltoid, coracobrachialis, biceps, brachialis anticus and triceps; he can extend, supinate and pronate the forearm fairly well, flex the wrist very well, and he flexes the second, third and fourth fingers well, the index finger very slightly, and the thumb not at all. The wrist extensors are but feebly functioning, and those of the thumb and index fingers not at all. Those of the last three fingers show about 75 per cent. of function. Sensation has returned save over the radial half of the forearm and hand, or corresponding to the distribution of the muscle spiral, musculocutaneous and radial nerves. The trophic changes in the limb show a marked improvement, save in the thumb and index finger. From an arm that was worthless this man now has a limb which, although it is far from normal, is extremely useful, and which in view of the fact that it frequently takes many months or even years completely to regenerate and reeducate nerves, gives

promise of still further improvement. Should the function of extension of the wrist not return, we shall ultimately transplant the tendon of the flexor carpi radialis into the common extensor tendons.

CASE 2.—A. W., man, aged 42, Dec. 23, 1913, while working in the flour mills, had his right arm caught between a belt and pulley, and he was thrown violently, striking a post with the root of his neck. There was immediate paralysis of his entire right arm and shoulder girdle, together with right sided enophthalmos, pseudoptosis and contracted pupil, indicating involvement of the sympathetic or ciliospinal fibers. The trapezius, levator anguli scapulae and rhomboidei were functioning: the serratus was paralyzed, but the pectorals were feebly acting. Sensation was lost from 3 inches below the axilla.

From these observations we concluded that all the cords of the brachial plexus were involved and that the lesions were high up, as the suprascapular and long thoracic nerves were injured, as were the sympathetic fibers in the eighth cervical and first dorsal roots.

At operation, Feb. 1, 1916, after the splitting of the clavicle, an anatomic dissection of the brachial plexus was made, and revealed that all of the cords were bound down by scar tissue near the middle of the plexus, that the first and second cords just after they emerged from the foramina showed definite neuromatous nodular enlargements, and that the eighth cervical and first dorsal nerves were buckled on themselves and relaxed, although they still were adherent by connective tissue to the foramina.

After all scar tissue about the plexus was dissected off, faradic stimulation of the various cords revealed a slight response from the muscles supplied by the suprascapular and musculocutaneous nerves, slight from the musculospiral and median but none at all from the ulnar nerve. Apparently the roots of the eighth cervical and first dorsal were torn off the cord, while all the other nerves had conduction interfered with by scar tissue either within or without the sheaths. The ulnar nerve was sectioned high, and by the end-to-side

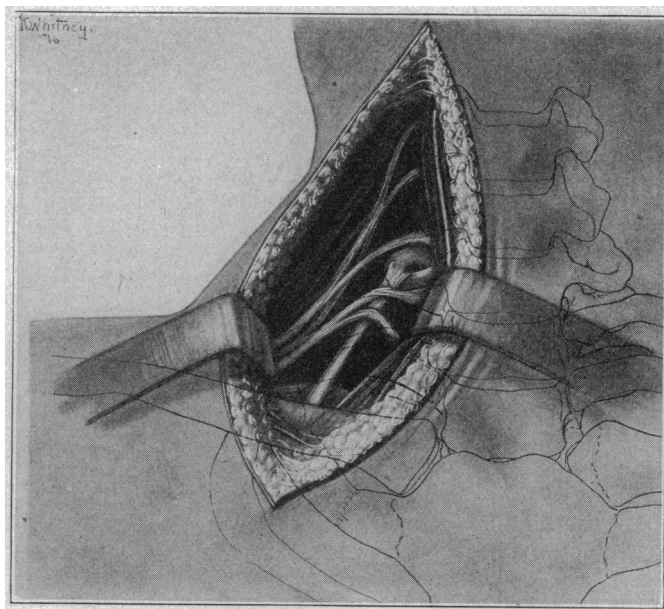


Fig. 5 (Case 3).—Adventitious ligament taking the place of a cervical rib; brachial plexus stretched over it.

method united to a notch in the musculocutaneous, that being the trunk giving the greatest faradic response, and the line of union was wrapped with a free fascial flap. The entire brachial plexus was then covered by a pedicled flap of axillary fat to prevent reformation of scar tissue. Now, four and one-half months later, the trophic improvement in the limb is marked, sensation has returned in the arm and forearm down to within 2 inches of the wrist, and there is also sensation in the thumb.

There is slight voluntary action of the biceps, triceps and deltoid muscles, and there is feeble extension of the wrist. This man's injury was so high and so extensive that there is no certainty of great improvement; yet the amount of regeneration to date is significant.

CONCLUSIONS

While none of the reported cases of avulsion in the adult in which operation was performed showed complete recovery, still enough function was regained to justify interference. Such interference should include nerve transposition when indicated, our warrant being the clinical and experimental evidence, which has proved the certainty of reeducation.

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ABSTRACT OF DISCUSSION

DR. DEAN D. LEWIS, Chicago: Surgery dealing with injuries of the peripheral nerves has been far from satisfactory. If we look over statistics dealing with a large number of cases of peripheral nerve suture we will be surprised to find that only about 36 per cent. of them can be regarded as distinct successes. It is also surprising to find that secondary nerve suture gives about the same results as primary. I believe that failure in peripheral nerve suture is often due to the fear of removing a sufficient length of the nerve to get well beyond the scar tissue, so that healthy axis cylinders are exposed which is essential to success. Studies on peripheral nerve regeneration have shown the marked ability of the fibers to regenerate. Regeneration of the axis cylinders is preceded by protoplasmic band formation which takes place from both ends of the divided nerves. These bands form conducting paths for the developing axis cylinders. I believe that fascia is the best material for tubulizing divided nerves. In some experimental work which Dr. Kirk and I did, we found that fascia is better than blood vessels for this purpose. The developing axis cylinders readily invade the serum in such a tube and the use of agar, as recently suggested by Edinger, does not seem necessary. An auto-transplant gives the best results, as determined by histologic studies, and the method of nerve transference recently suggested by Hofmeister seems to be a distinct advance in this class of work. Dr. Law is to be congratulated on the results he has had in these two cases because the technic required in dealing with injuries of the brachial plexus is difficult, and consequently the functional results are often disappointing.

DR. ARTHUR A. LAW, Minneapolis: We did some experiments at the University of Minnesota to disprove the theory of positive neurotropism that Forsman brought out. It did not seem like good pathology. In a series of animals we sectioned the musculospiral nerve and avulsed the distal segments so they could exert no attraction for the proximal segment. We then inserted the proximal nerves into little fascial bags and stitched them there. We found that this little fascial sac ultimately was filled with nerve fibers, notwithstanding that they lacked the influence of chemotropism of the distal fragments.

Longevity and Race.—There is reason to believe that certain races live longer than others, and undoubtedly inhabitants of temperate climates live longer than tropical races. Humphry pointed out that old age is a product of civilization because the savage when his strength decays cannot live. Moreover, civilization provides pensions for those who are too old to work, and by the cultivation of the humaner feelings has made the maintenance of the aged a duty which is generally cheerfully performed. But the savage is free from most of the diseases which attack civilized man, and consequently that state of society in which there is enough civilization to temper the lot of the aged and not enough to corrupt the young is the most favorable for the attainment of a long life.—Saundby.

THE INTEREST OF THE COMMUNITY
IN CANCER*

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The interest of the community in cancer can best be characterized, perhaps, by contrasting this disease with another that is still more familiar, namely, tuberculosis. The average age at death from tuberculosis is about 37 years; from cancer it is about twenty years greater. Tuberculosis affects primarily the economic interest of the community. The decedent is usually at the highest point of his efficiency; his productive period is still largely in the future; his children are either very young or still unborn. In cancer, on the other hand, the productive period is for the most part in the past; the children have been born, and the family unit is only slightly disturbed economically by the death, since in the majority of cases the offspring have reached the age of self-support and independence. It is, therefore, the emotional interest that is uppermost. The long suffering patient, and the utter hopelessness of the condition in its advanced stages, appeal tremendously to the humanitarian feeling of the community. The economic interest in cancer, although important, must remain secondary.

Our interest is accelerated by the mystery that still surrounds the disease. The prevalence of cancer has been noted in the earliest history of civilized man. Today it is responsible for one death out of every fourteen among men, and for one death out of every nine among women, after the age of 50. Yet, in spite of the wealth of clinical material and the concentration of effort, it has withstood every attempt of the physician and scientist to unravel its secret. The world is still baffled as to the cause of cancer. Only a beginning has been made in its study; the heart of the problem is still sealed to us. The scientific spirit of present-day medicine demands an explanation, and the community as a whole supports this demand insistently and wholeheartedly.

Additional interest results from the disquieting fact that the cancer rate may be increasing. The chief sources of information on their face indicate an increase. This holds true not only for the Registration Area of the United States and for those of our states whose records are most reliable, but also for the United Kingdom, for Switzerland, for Germany and, indeed, generally throughout the civilized world. I shall not go into the complex statistical problem involved in determining whether this increase is real or only apparent. Equally good authorities have divided on this important question. My own judgment is that there may very well be an increase. I am struck, however, with the number of possibilities of serious error in using figures which are usually quoted to prove an increase, especially in our own country. The figures are too striking to be true. In the ten-year period from 1901 to 1910, there was an increase of 30 per cent. in the male cancer rate, and of 22 per cent. in the female cancer rate, at all ages beginning with the age of 25, in the state included in the Registration Area in 1900. At certain age periods this increase was very considerable—as much as 40 per cent. The unreliability of these figures is at once apparent when we think of cancer as

* Read before the New York Academy of Medicine, in association with the American Society for the Control of Cancer, May 18, 1916.