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[Read before the Philadelphia Academy of Surgery, November 6, 1893.]

TUMORS OF THE PERIPHERAL NERVES; WITH THE REPORT OF A CASE OF SARCOMA OF THE SCIATIC.

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All tumors growing in or upon peripheral nerve trunks have come to be classed as neuromata, and of these two general divisions are made—the true and the false. The true neuroma is composed of nerve elements, while a false neuroma is a tumor developing in connection with a nerve or its sheath, but not composed of nerve elements. Virchow has proposed that only true nerve-tissue growths be called neuroma, while other tumors growing in connection with nerves shall receive the same name as would similar neoplasms occurring elsewhere. This more simple and accurate method of classification has not, however, been followed generally by writers.

Fibroma is the common tumor found in connection with nerve trunks, and is usually composed of white fibrous material with few connective-tissue cells. Plexiform and multiple neuromata are usually congenital and often hereditary, slowly growing varieties where a number of nerves undergo a fibrinous change and occasionally form plexes of sensitive interlacing cords. The subcutaneous terminal extremities of sensory nerves may undergo fibrous changes and form the so-called "tubercle dolorosa." According to Bowlby[1] sarcoma is next in order of frequency. "They may belong to the round, oval, or spindle-celled varieties. In such growths, especially in those which increase most rapidly in size, degeneration cysts may form so that the tumor may become partly filled with fluid. The contents of such cysts are usually blood and broken-down cells." Very rarely myxomas are met with. In these the mucoid material grows from the nerve sheath. Glioma, as may also be said of syphiloma, is all but unknown excepting upon the cranial nerves, and even upon these is almost never observed beyond the confines of the cranium. Two cases of simple

[1] Injuries and Diseases of Nerves. London, 1892.

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cyst containing clear fluid, in connection with nerve trunks, have been recorded by Bowlby. I have found references to cases upon record as fibro-sarcoma, myxo-sarcoma, and cavernous sarcoma, also to "blood-cyst" of nerve trunks—the two latter, in the light of modern pathology, probably being instances of cystic degeneration of simple sarcoma. All nerve tumors show a marked tendency to malignant degeneration. Secondary or metastatic tumors of nerves are probably not uncommon. Probably more records of tumor of the optic nerve than all others put together are to be found in medical literature, but nerve-trunk tumors must be considered as rarities when judged by the very small number that I have been able to find reference to in the books and *Index Medicus*.

Diagnosis before operation, except in the case of superficial neuromata, unless there are marked motor or sensory disturbances, is almost impossible in the majority of cases. Even these symptoms may be simulated by pressure upon the nerve by outside growths. It is a remarkable fact that most tumors of nerves give rise to but trivial changes of sensation, and the conveying and trophic power of the fibres is almost never fully destroyed. When the tumor has actually been exposed by dissection, unless the surgeon is exceedingly careful, a nerve is liable to division or other injury before the true nature of the growth is discovered. Cases are upon record where excellent surgeons have not recognized the nature of tumors until the ensuing paralysis of function and the microscope have solved the problem.

Removal of those neoplasms which involve all of the bundles necessitates total division of the nerve trunk above and below the tumor; which should be followed, if possible, by immediate approximation of the ends by the employment of some one of the various methods of suturing, lengthening, or splicing, and the subsequent placing of the parts by posture in that position which gives greatest relaxation to the nerve trunk involved. Where approximation is impracticable the ends should be "aimed" at each other by chromic catgut sutures, and regeneration with more or less restoration of function may be expected to slowly supervene in many cases. When the growth involves simply the sheath of a nerve, either internally or externally, prompt recognition of its nature and relations, together with careful dissection, will prevent injury to the nerve itself. If the tumor is within the sheath—as in my case—a longitudinal division of the sheath without division of any of the nerve fibres will be sufficient to fully expose it. If then it is found to arise from a few of the nerve bundles these may be divided and the growth shelled out of its bed, if possible, without rupturing the capsule if it possess one. Any small number of fibres that may be thus divided may be expected to regenerate and coalesce; larger bundles should at once be sutured with catgut.

Subsequent suture of the divided sheath would appear to be a neat point of technique, but, as proved in the case here reported, is sometimes unnecessary. On the other hand, the possibility of hemorrhage taking place within a tightly sutured sheath must not be lost sight of. Gowers is authority for the statement that excision of nerves on account of tumor is prone to be followed by the development of bulbar (traumatic) neuromata. This may have been true of nerve sections prior to the antiseptic period, but absence of suppuration, combined, as it often can be, with immediate suture should render such results here, as elsewhere, very unusual.

The history of the case which has suggested these remarks is as follows:

Mrs. D. A., aged forty-two years, a Russian of the middle class, entered the Polyclinic Hospital October 3, 1893, with a tumor upon the back of the left thigh. Family history negative so far as could be secured. Physical examination, excepting the tumor, negative. Urine normal.

She stated that about one year previously she had accidentally discovered a small nodule deeply situated upon the posterior portion of the left thigh; that it had grown slowly at first, but during the past three months with increasing rapidity; and that, excepting inconvenience in sitting upon the mass, which gave rise to some pain, the tumor had caused little or no discomfort. No definite history of any sensory or motor disturbance in the sciatic distribution could be elicited.

The growth was the shape and size of a large goose-egg, with its long axis corresponding to that of the thigh. It lay exactly over the course of the great sciatic nerve, midway between the tuberosity of the ischium and the flexure of the knee-joint. It could be moved somewhat from side to side, but almost none at all upward or downward. It did not move when the posterior muscles of the thigh were exerted. To pressure and palpation the growth was almost insensitive. It felt like a soft fibroma or fibro-lipoma but did not impart any sense of fluctuation.

On October 6th a careful dissection was made and the tumor exposed at the base of a six-inch incision. It was noted that each time the growth was impinged upon by the finger or an instrument the lower leg gave a sharp, convulsive start. When moderately cleared of its surroundings the fact that a neoplasm involving the sciatic nerve was to be dealt with was made very evident by observation that the fibres of that nerve could be seen as glistening white cords of varying size beautifully frayed or spread out as they ran around the growth through the encapsulating nerve sheath. A vertical incision, avoiding nerve fibres, was made to the full extent of the tumefaction through this apparent capsule, when it was further discovered that the tumor proper was entirely

disconnected with the sheath, and was separately enclosed in a capsule within. The growth was readily separated from the sheath of the nerve in all directions except at points at the extreme proximal and distal extremities, where a few nerve fibres entered and emerged from it respectively. Some small bloodvessels appeared to accompany the strands of nerve substance into the tumor. These fibres having been divided, the growth was lifted out without further difficulty. Upon examining the cavity in the nerve sheath from which it came it was observed that most of the bundles of the sciatic were in advance of and had been spread out over the external surface of the growth, but that no appreciable injury had been done them with the exception of the few fibres which had necessarily been divided as they entered the tumor. No sutures were applied to the nerve sheath nor were any ligatures called for. The wound was closed without drainage by alternate deep and superficial silk sutures and a pad of dressing so applied as to make compression upon the cavity left by the tumor. The operation was followed for two days by some pain in the whole sciatic distribution, but especially in the region supplied by the external popliteal, but no loss of power ensued. All pain disappeared in forty-eight hours, however, and afterward she had no disagreeable sensations. Upon the seventh day all sutures were removed and absolute primary union throughout was found. On the tenth day she began to walk about, and four days later walked home, apparently as well as ever. Up to this date she has so continued.

The tumor was ovoid in shape, four inches in length and seven in circumference where thickest. At either extremity a few nerve fibres and bloodvessels appeared to enter or take their exit. Otherwise there were neither adhesions nor pedicle. The growth was encapsulated with a tough brownish-colored membrane which brought away small granular portions of the tumor when forcibly separated from it by peeling. The neoplasm proper was of a yellowish-brown color, rather dry, and cut like fibro-fatty tissue. Exactly in the centre of the mass was a cavity, not definitely separated from the growth, which contained about half an ounce of bloody fluid. Most unfortunately, during the preparation of the specimen for further study it was accidentally destroyed, so that I have not the satisfaction of adding to my clinical and gross pathological diagnosis of sarcoma that of microscopical confirmation. However, the details of several cases almost identical with this in every way, which I append, where sarcoma was proved by the only accurate method, will, I trust, be found to justify me in classing this case as one of that dread malady.

From the scant literature of peripheral nerve tumors I have abstracted the following cases, which are of great additional interest from the evidence which some of them afford relative to the

remarkable regenerative powers of nerves, even when great lengths have been removed with tumors and suture has been omitted or found impossible.

Hume[1] reports the case of a man, aged twenty-four, who presented himself with a tumor on the back of the left thigh, which he had observed for five months. It extended from the fold of the buttock to the upper part of the ham, being ovoid in shape and movable from side to side, but not from above downward. There was much pain in the knee and foot, but no loss of motion or sensation. The tumor was easily shelled out with division of the entire nerve above and below. The growth was surrounded by and incorporated with the strands of the nerve. Besides the main portion of the tumor, the nerve trunk above and below appeared to be infiltrated with the same material, so that it was necessary to remove in all six inches of the sciatic. The cut surface of the growth was of a yellow fatty appearance. There were several hemorrhagic spots in its substance; also others that looked like necrotic or caseating patches. It proved to be sarcoma. The man, soon after operation, was able to walk upon the limb, but there was much wasting and great impairment of sensation. Below the knee palsy of muscles and sensation was complete six months after operation.

A second case, recorded in the same place by Hume, was that of a man, thirty-seven, who had noticed a nodule under the gluteus maximus of the left side four months before coming under observation. He had been subject to molluscum fibrosum from childhood. At the time of operation the growth had attained the size of a "melon." It was found to originate in the great sciatic, the strands of the nerve being stretched over and incorporated with the capsule of the tumor. The small sciatic lay over the tumor and was pushed aside. To remove the growth it was necessary to entirely divide the nerve close to the sciatic notch above and at the border of the gluteus below. By stretching of the nerve ends and extreme flexion of the knee and extension of the hip, all of the upper end of the nerve and one-half of the lower extremity were brought together and sutured with strong catgut. In order to lessen strain upon the sutures the patient was made to assume the prone posture with the hip in extreme extension. The tumor was found to be a round-celled sarcoma. There was primary complete paralysis of the functions of the sciatic. Eighteen months later skin sensibility of the foot was absent, but that above the ankle was almost normal, and there was very little atrophy of the muscles. At this time he presented a large sarcoma of the right chest wall, with pleural effusion, and died five months subsequently. It was

[1] Lancet, September 19, 1891, p. 654.

then found that he also had a growth in connection with the pleura; nodules in several of the intercostal nerves, the liver, and in the humerus and lung of the opposite side. At the site of operation the sciatic nerve was found at the level of the tuberosity of the ischium to be divided into two portions; the internal of these passed into a nodular swelling, which was continuous upward with the proximal portion of the nerve; the external portion was lost in cicatricial tissue, by which it was attached to the surrounding parts and to the side of the nodule. The whole thickness of the lower end of the central portion was continuous with the nodular swelling. The latter had evidently formed at the line of suture with that portion of the peripheral division of the nerve which it had been possible to bring into contact at the operation. The nodule consisted entirely of nerve tubules and fibrous tissue. There was no local recurrence of sarcoma.

Hume, in the same article, also records the following case: A man, aged forty, had recognized a rapidly growing nodule behind his knee for four months. Upon incision a large oval growth of great vascularity was found in connection with the internal popliteal nerve. The short saphenous nerve was stretched over it, thus explaining all pain that the patient had suffered. Three and a half inches of the nerve were excised. The ends were not sutured. The man soon returned to his occupation of miner, with paralysis of the popliteal distribution. The growth was encapsulated in the sheath of the nerve and appeared to be defined at each end, but a small number of nerve fibres passed through it. The bulk of the substance of the nerve laid behind the tumor. In its interior one or two cavities filled with blood were found. Six years subsequently the cutaneous sensibility of the leg had returned to the normal, excepting a slight impairment in the centre of the sole, and all muscular movements of the leg and toes were perfect. There was no wasting of the parts whatever.

Little[1] reports the following case: A woman, aged twenty-five, presented a large, firm tumor upon the posterior portion of the thigh above the popliteal space. The first symptoms were dull pains along the thigh and upward. There was no pain in walking, but considerable discomfort in sitting. The tumor pedicle sprang from the sciatic nerve sheath. One inch of the nerve was resected and the ends sutured together. The functional result was almost perfect in a few months. The growth was twelve inches in circumference. It proved to be a sarcoma, and probably originated from the neuroglia. There was a true bony centre in the tumor.

McBurney[2] records a case where a man, aged twenty-seven, pre-

[1] Boston Med. and Surg. Journ., December 3, 1885, p. 533.
[2] New York Med. Journ., May 1, 1886, p. 504.

sented a growth of six years' development upon the inner side of the right arm. There had been no considerable pain until a month before operation; the pain extended down the arm, and pressure was exceedingly painful. It was found to spring from the median nerve in the upper third of the arm; was encapsulated, and, when opened, it was seen that the fibres of the nerve spread over the growth. The major portion of the tumor was behind the nerve. The neoplasm and capsule were removed with division of but a few fibres of the nerve which entered it. Microscopic examination proved the tumor to be fibro-sarcoma.

In addition to the above detailed cases I have been able to find the following references to sarcoma of nerve trunks;

Ramoneda: Sarcoma fuso-cellular del nervio neumogastrico derencho; su extirpacion, conservándose la continuidad del tronco nervioso; datos interesandes acerca del nervio hipogloso. Rev. clin. de l'hosp. Madrid, 1891, iii., p. 241.

Van Inschot: Fibro-sarcome caverneux du nerf radial (propagé au triceps brachial). Ann. Soc. de Méd. de Gand, 1887, lxvi., p. 14.

Weile: Ein Fall von Sarcom des Nervus radialis. Erlangen, 1888, 8vo.

Bardeleben: Sarcom des Nervus ischiadicus. Charité Ann., 1883, Berlin.

Herczel: Ueber Fibrome und Sarcome der peripheren Nerven. Beitr. zur path. Anat. u. z. allg. Path. Jena, 1890, viii., p. 38.

Peret-Gilbert: Considérations sur les néoplasmes primitifs des nerfs des membres. Paris, 1891, 4to.

Krause: Ueber maligne Neurome und das Vorkommen von Nervenfasern in denselben. Samml. klin. Vortr., 1887, No. 293.