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(WITH REPORT OF A CASE.)

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(With Report of a Case.)

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WHEN, in connection with the rarity of nerve-tumors, we consider the complex structure of nerve-tissue, we can easily understand the confusion that exists in the nomenclature and classification of these tumors, and their generally undetermined pathological structure. Thus, in an ordinary nerve-trunk we have the nerve-fibers proper surrounded by their medullary coats of myelin, this limited by the neurilemma, set in the endoneurium, and this again surrounded by the laminated perineurium, and all included in the coarser connective tissue of the epineurium. Each differs in its structure, and each is liable to the pathological changes to which all tissues are subject, each is liable to its own peculiar changes, and any two or all of them are liable to be attacked at the same time. Add to all this the difficulty of demonstrating axis-cylinders and other nerve-structures satisfactorily by ordinary histological methods, and what wonder that we seldom find

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two nerve-tumors described as being similar in structure?

The confusion begins in the very title. The clinical surgeon has few means during the life of a nerve-tumor to diagnosticate its structure, whether of fibrous tissue, or of pure nerve-tissue only, or mixed. He has therefore, of necessity, come to classify all tumors connected with and inseparable from nerves as neuromata.

On the other hand, pathologists, and especially the German pathologists, insist that it is highly improper to call a tumor a neuroma that has no true nerve-tissue in it.

We must, however, give some name to these tumors before they get into the pathologist's hands, and in the absence of a better we shall, therefore, adhere to the old definition that all tumors connected with and inseparable from the nervous system are neuromata. But when we come to a true scientific classification we find these growths divided into two great classes, not always distinct from each other, true neuromata and false or spurious neuromata. In the former the characteristic and predominating tissue is nerve-tissue, while in the atter the nerve-elements are absent, or occupy only an accidental or subordinate place. All neuromata are rare, but true neuromata are found much more seldom than the spurious.

True neuromata may be divided into three classes:

1. The ganglionic, medullary, or cellular neuromata.

2. The fasciculated or fibrillar neuromata, and—

3. The plexiform neuromata.

The ganglionic are found almost entirely in the nerve-centers, and are made up chiefly of ganglion-cells and naked axis-cylinders. They are rare, and are not of surgical importance.

The second variety, however, is of more interest. Its characteristic tissue is constituted of ordinary nerve-fibers set in connective tissue, the arrangement of the two varying greatly in the different specimens. As long as the connective tissue does not too greatly predominate and is related to the nerve-elements as its matrix, the growth is still called a true neuroma. There are said to be some tumors in this class, although they are very exceptional, in which the constituent nerve-fibers are non-medullated. Such tumors are consequently termed amyelinic, to distinguish them from the myelinic neuromata, or those having medullated fibers.

The usual seat of neuromata is in the course of the spinal nerves, principally in the extremities, but they are sometimes found on the cranial, and very rarely on the sympathetic nerves. The growths usually appear as simple spindle-shaped or oval enlargements of the nerve, are usually symmetrical in shape, sometimes flattened, and of any size up to or even larger than a hen's egg. They are said to be generally grayish in color, and firm and elastic to the touch. They seem to be produced by a local hyperplasia leading to an hypertrophy of the nerve-structures, and can often be traced to an irritation or injury to the nerve. This injury is sometimes subcutaneous. That the lesion may first cause simple inflammatory changes, and these lead to hyper-

trophic changes, there can be no doubt. It is said that neuromata do not always invade the entire nerve-trunk, but that they may grow upon only a section of it, crowding the remainder to one side. To this class belong the terminal, traumatic, or amputation neuromata found in stumps. These tumors are said to be usually connected to the cicatrix by small radicles. They are generally small in size, and only exceptionally cause any inconvenience.

We find placed in this class those tumors that develop in the peculiar constitutional condition that is characterized by the formation of a great number of nerve-growths, although they may be more properly fibro-neuromata. These multiple neuromata sometimes develop in immense numbers—in one case estimated at over two thousand. They sometimes appear only on one nerve, sometimes on a single set of nerves, and sometimes throughout the entire nervous system. This condition occurs almost exclusively in males, and may perhaps be due to some hereditary neurotic taint. It is not infrequently seen in cretins, and a few cases have been encountered in idiots.

The third variety mentioned—plexiform neuromata—includes those rare congenital growths made up of varicose-like convolutions of hypertrophied nerve-cords. They are so rare as yet to have no clear distinctive description, and are often confused with other similar tumors. They may lie deeply, or be immediately beneath the skin. They most frequently occur on the branches of the fifth nerve, but have been found in various other locations.

Nerves are liable to all the pathological changes

that occur in other tissues, and these localized changes constitute the usual cause of the simpler false neuromata. Of these by far the most common is the fibroma. This may origininate in any of the fibrous tissues of the nerve, and may grow to a considerable size without affecting the nerve-tissue proper. Thus, if in the epineurium or laminated perineurium, it may grow only on one side of the nerve as a pedunculated or semi-detached growth, or it may completely encircle the nerve, forming a cylindrical sheath, which may be easily dissected away. If it arises in the interior connective tissue it may crowd the nerve to one side, which will then pass in a sort of groove in the tumor; or, if still more central, it may divide the nerve into several fasciculi that may become widely separated, but may still remain distinct and easily separable from the fibroma. These growths are generally harmless, and seldom interfere with the functions of the nerve. Clinically, they closely simulate the fibrillar neuromata, but are apt to be more globular and not so spindle-shaped as the true neuromata; they may be more laterally attached to the nerve, and hence more movable.

The fibromata, again, are clinically closely simulated by the myxomata, which are said to be the next most frequent in occurrence of the non-malignant spurious neuromata. Nerve-cysts are also occasionally found, as are also such mixed tumors as cysto-myxomata, fibro-myxomata, lipomatous myxomata, etc. Spurious neuromata may also be due to malignant diseases of the nerve. Of these, sarcomatous growths are the most common, while

primary carcinomatous tumors are very rare indeed. Gummata are rare in nerves, except in the cranial nerves. In leprosy a peculiar true neuroma is often found present, and may play some part in the pathology of the disease.

Closely connected with neuromata, but not properly belonging to them, are the painful subcutaneous tubercles—the neuromata dolorosa of Virchow—of which much has been written. These are little nodular bodies, the seat, or rather the center, of excruciating intermittent and remittent pain and tenderness. A drawing sensation, not definitely localized, is also sometimes experienced about them. They vary in structure, being sometimes described as simple fibromata, sometimes like true neuromata, but they are generally much more complex. They are not always found to be connected with the nervous system, but, of course, are probably so connected. It seems reasonable to suspect that they are altered or hypertrophied superficial nerve-endings, although this has not yet been demonstrated. They occur most frequently on the arms, back, and neck, but may occur at any part of the body. They are much more frequently found in women than in men. Where not too numerous, treatment by simple extirpation is satisfactory.

Neuromata in general have no characteristic symptoms. When situated on a large nerve-trunk there are generally more or less defined neuralgic pains, sometimes terribly severe in intensity, intermittent and remittent in occurrence, and seemingly affected by external and constitutional circumstances, as in true neuralgia, or there may be only a deep,

dull aching. Later on, sensory symptoms, such as formication, tingling, and numbness, and such motor affections as twitchings, tremors, and weakness may develop. Actual sensory and motor paralysis, if seen at all, usually are late in appearance. Indeed, one is surprised to find how few and how slight the symptoms are, and the symptoms do not seem directly to depend upon the size of the tumor.

In heterologous growths, when the nerve is invaded and destroyed, we, of course, expect to find more rapid growth and greater loss of function in the parts than are found in simple growths. When a tumor develops in a bony canal, we expect paralysis below from pressure. Occasionally, reflex symptoms are encountered, such as pain and muscular contractions. Even epileptiform convulsions have been stopped by the removal of a superficial neuroma. When the symptoms are marked, weakness is generally noticed in the muscles supplied by closely associated nerves.

Neuromata cannot be diagnosticated from symptoms alone. When the growths are superficially situated they are sometimes found to be tender, and manipulation may cause pain in the distal course of the nerve. But even these features are remittent. In idiopathic neuromata the tumor may vary in size from time to time, and may even disappear. We are assisted in diagnosis by finding that the tumor is in the course of a nerve, and that it is freely movable to one side of the nerve, but fixed in the other direction. Pain and tenderness in the tumor, and in the nerve beyond, can generally be abolished

by pressure on the nerve above the tumor. Non-traumatic, non-malignant neuromata are very slow in development, but they may occur at any age, and may grow to any size. Virchow states that they are found more frequently in the tuberculous and scrofulous diatheses. They are benign, but true neuromata have a tendency to recur after removal.

When treatment is demanded, extirpation is alone of benefit, but should not be lightly undertaken. In case of multiple neuromata it is unwise to attempt removal, and this should be undertaken only when some one local tumor is causing great and persistent distress. In these multiple growths the prognosis is generally good, as they appear seldom to directly affect the duration of life.

The case that I present herewith is one of much interest:

Miss Jennie S., unmarried, twenty-three years of age; is a native of Sweden, but came to Kansas twelve years ago. In childhood she had attacks of quinsy, and when first in Kansas had malaria severely. She gives no history of any other disease, and I can discover no tuberculous or scrofulous taint, and no specific history. She was well and hearty, when in May, 1889, she struck her arm on the sharp corner of an ice-chest. She scraped the skin, and suffered a severe bruise over the inner side of the lower portion of the arm. The part was sore for about a week, when all symptoms disappeared for about two months. The girl then began to have shooting pains from the seat of the injury down into the little finger and hand. Swelling or other symptoms were not observed. In the following fall, as

the pains were growing worse, she placed herself under medical treatment. During the winter, the pains and "queer" sensations in the arm and hand progressively increased, and at night became so severe as to prevent sleep. In the spring of 1890, while on her way to Denver, she noticed the arm swelling about the site of the bruise; the pains became intense, and soon the hand also swelled. The swelling in the arm was said to be an abscess, and was poulticed, but was never opened. The swelling gradually subsided, but the little finger remained blue, weak, painless, without feeling, and seemed in the way. As the swelling left the arm, a small lump remained. Soon the pain began to return, and became very severe at night, the tumor gradually increasing in size. As it did so, the hand got weaker and more awkward; it was numb and tingling, and there was no feeling on the inner side, so that the girl was constantly burning and hurting it unconsciously. She says that she noticed wasting of the inner side of the hand, the ball of the thumb, and between the bones of the hand. This grew worse gradually, the hand becoming very awkward and in her way. On February 5, 1891, she called upon Dr. Eskridge, who examined her and made the following notes of her condition, which he has kindly allowed me to use here:

"Sense of touch was completely lost in the little finger of the left hand, and in the corresponding portion of the hand to the wrist-joint. Tactile sense was present on the ring finger on both the inner and outer surfaces. Tactile sense normal over the arm and forearm. Pain-sense affected only in the little finger, where it was simply lessened, not abolished. Temperature-sense in the same region lessened. The little finger could neither be flexed nor extended. It remained in a semi-flexed position,

on account of rather firm contractions of the flexor muscles. It was impossible for her to abduct or adduct the little finger. The grasp of the left hand was very weak, and the whole hand was moved slowly and awkwardly. Only the muscles of the little finger were tested by electricity, and these were found partially degenerated."

Dr. Eskridge subsequently advised her to go to the County Hospital, which she did, and was there placed under my care.

I first passed an exploratory aspirating-needle into the tumor, as there seemed to be obscure fluctuation in it, but the only result was to cause intense pain—the old pain, she said—down into the little finger.

On February 24th we operated by cutting down longitudinally over the tumor, which was found to be a symmetrical spindle-shaped enlargement of the ulnar nerve, its center being about three inches above the elbow. The tumor itself was about two and a quarter inches long and two inches in circumference, but the entire nerve, as far as it was exposed in both directions, was found much hypertrophied and hardened. No line of demarcation between the nerve and tumor could be found, the latter being to all appearances simply an enlargement of the former. After dissecting the tumor perfectly free on all sides it was incised longitudinally, and gradually split quite in two. Within a definite capsule a grayish-white substance was found, growing softer toward the center, and closely resembling the white substance of the brain. In the center was a cavity filled with a thick, gray, grumous substance, probably desiccated pus. The matter appeared homogeneous throughout. The nerve was then divided just above the tumor, and the tumor drawn up so as to stretch the lower portion of the nerve as much as

possible. The nerve was then divided just below the tumor, and the extremities still not approximating, the upper portion was grasped by the fingers and drawn down forcibly as far as possible. Although two and a half inches of the nerve had been removed, the extremities were then brought to within three-eighths of an inch of each other by means of two strong catgut sutures passing completely through each nerve-extremity at right angles to each other. The wound was then closed entirely, and the arm from the shoulder to the knuckles placed on a straight splint. The patient was kept in bed. On the second day it was found that some sensation had returned in a small area on the little finger, and that there was some power of motion in the finger. The wound healed by first intention, pain disappeared entirely at once, and though the hand was swollen for some time, improvement soon set in and has ever since continued. The straight splint was kept on for about five weeks, but the hand was not allowed to be put to any use for seven weeks. It was then treated by massage. By rapid and constant improvement, strength and sensation almost completely returned.

At the present time the hand appears normal, except that the muscles of the third and fourth intermetacarpal spaces seem still wasted. The grip is strong, and the hand seems as useful as it ever was.

I here give the report made by Dr. Lobingier, the pathologist of the hospital, to whom the tumor was submitted for examination :

"The tumor belongs to the class of fibrillary myelitic neuroma, and consists of collections of nerve-fibers bound together by connective tissue, running in some instances directly and in other places tortuously through the tumor. Consequently some of the nerve-fasciculi fall directly in cross-

section, whereas others appear wavy and parallel, or branched, being cut longitudinally. Certain sections show a preponderance of fibrous tissue, richly studded with leucocytes. One area, which appears in almost every section, is remarkable, in that the nerve-bundles are in various stages of waxy degeneration, and this, in cross-section, appears dense and homogeneous. Owing to the fact that the tumor was hardened before it came into the demonstrator's hands, it was impossible to stain the axis-cylinders, as could have been done in the fresh specimen with gold chloride. The medullary sheath and white substance of Schwann may be made out in the cross-sections of the fasciculi. The neoplasm is remarkable for its excessive vascularity, and the waxy degeneration of certain nerve-studded areas, an unusual phenomenon."

What the ultimate outcome of this interesting and perhaps unique case will be remains to be seen. As we have said, these tumors tend to recur. In this case a much-thickened and greatly-stretched nerve was sutured, leaving a considerable interval. These conditions, I fear, give ground for apprehension.

I have little doubt that the blow two years ago set up a traumatic neuritis, which resulted in the extensive thickening, and later in a local intra-neural suppuration. This became quiescent after so permanently damaging the nerve as to make its functions hopeless without surgical interference.