

PART II.

DISEASES OF THE SPINAL NERVES.

THE nerves of the spinal cord, which are called spinal or peripheral nerves, arise, as is well known, by an anterior smaller, and a posterior larger root. These are flat bundles of fibres, loosely surrounded by the arachnoid, which pass into the intervertebral foramina, where the posterior roots form a swelling, the ganglion intervertebrale, and emerge from the spinal canal, the two roots having united to form a common round trunk. This again divides after its exit from the canal into two branches, an anterior and a posterior. The anterior, usually the larger, forms numerous anastomoses with the branches above and below it, the so-called ansæ, which are collectively called plexuses. The posterior, smaller nerves, pass backward between the transverse processes of the vertebræ, and are distributed to the muscles and the skin of the back.

Of the thirty-one pairs of spinal nerves, there are eight cervical, twelve dorsal, five lumbar, five sacral, and one coccygeal. The posterior as well as the anterior branches contain fibres from both roots. The anterior roots are motor (Charles Bell, 1811). They supply, besides all the muscles of the trunk and extremities, the unstriped muscles of the internal organs and the unstriped muscles of the vessels. The posterior roots are sensory, but we should keep in mind that the anterior most probably contain, besides the motor, also trophic and secretory, and the posterior roots, besides the sensory, also fibres for the reflexes (cf. also Sass, *Deutsche Med.-Ztg.*, 1890, 12).

The peripheral nerves, just as the cranial, may be affected independently or secondarily, and as the result of some primary disease in other parts. In cases of the first class overstrain plays an important rôle, often also, as we have seen to be the case in diseases of the cranial nerves, exposure to cold and traumatism, while in those of the second class a great many factors come in, more especially infections, intoxications, and general cachexiæ; of these we shall speak when we treat of the individual nerves.

If we inquire into the anatomical character of the disease we shall in many instances have to admit that we are unable to find any anatomical changes whatever in the affected nerves. This is true in many cases of mild neuralgias, but also in some of the severe, even of the severest, types. The examination of pieces of the trigeminus, for instance, which were cut out where a resection had been made on account of intolerable pain has by no means always revealed appreciable changes in the nerve; on the contrary, this has on microscopical, as well as on macroscopical, examination repeatedly been found to be absolutely normal. In other instances, however, an inflammation—i. e., a neuritis—could be demonstrated as having been the cause of the trouble. In such cases there is seen in the acute stage an exudation in the interstitial tissue and an abundant infiltration of the same with round cells, a condition which gives rise to a swollen and œdematous appearance of the nerve ("purulent neuritis"). If this inflammation continues for some time the process goes on to degeneration, under the influence of which a part of the myeline sheath is destroyed and compound granular corpuscles are formed. The axis cylinders generally remain for some time intact. In some bundles there may be found nerve fibres completely atrophied, while the sheath is somewhat thickened and irregularly contracted, presenting a wavy outline. This increase and condensation of the connective tissue makes the nerve look more and more like a cord of connective tissue, which is thinner or thicker than normal according to the amount of the newly formed tissue; sometimes, also, it is in places irregularly thickened (neuritis nodosa). The pigment deposits found have to be looked upon as the remains of previous hæmorrhages. Even after extensive destruction of the nerve fibres by the connective tissue, regeneration is to a certain degree possible, as the peripheral nerves possess this power to a considerable extent, a point which is of importance for the prognosis. According as the advance of the process is centrifugal or centripetal we speak of a descending or an ascending neuritis. A neuritis migrans has also been described. If the process occur simultaneously at different places, we speak of a multiple or a disseminated neuritis (Leyden, Roth). From the researches of Scheube we should be led to regard the so-called beri-beri, or kak-ke, a disease which occurs epidemically in Japan, as a multiple neuritis. In very chronic cases the inflammatory

changes in the connective tissue are so slight in comparison to the degenerative process in the nerve fibres that it is preferable to speak in those cases (as Strümpell has proposed) of a "primary chronic degenerative atrophy of the nerves," instead of a neuritis.

The symptoms of neuritis, of course, vary according to the position and the function of the affected nerve, as we shall show in the following pages. The symptomatology of the primary multiple neuritis *par excellence* we shall describe later.

The peripheral nerves may also be the seat of neoplasms, which, when developing in them, usually start from the connective tissue. Only rarely do they consist of newly formed nerve fibres, and deserve properly to be called neuromata; much more frequently they are fibromata, which may be found as solitary or as multiple new growths, and which not uncommonly may give rise to thickenings and nodular swellings, which can be easily demonstrated and felt on the nerves. Extensive tumors, where numerous nerve trunks are united by connective tissue into a compact mass, the so-called plexiform neuro-fibromata, are rare. Malignant neoplasms, carcinomata, and sarcomata of the peripheral nerves are sometimes met with. That here, also, the symptoms depend on the seat of the new growth is self-evident (cf. Krause on Malignant Neuro-mata and the Occurrence of Nerve Fibres in them. Volk-mann'sche Sammlung klin. Vorträge, 293, 294, 1887. Deutsche Med.-Zeitung, 1888, No. 15).

We shall first speak of the affections of the motor and the sensory nerves which innervate the muscles of the extremities and the trunk, and certain internal organs which are not connected with the cranial nerves, and after that we shall turn our attention to the trophic, the vaso-motor, and the secretory fibres as far as our scanty knowledge on these points will allow. An appendix will be devoted to the primary affections of the muscles supplied by the spinal nerves.

A. DISEASES OF THE MOTOR AND SENSORY NERVES.

I. Diseases of the Cervical Nerves.

Of the four upper (smaller) cervical nerves, the first, which is called the suboccipital, emerges between the occipital bone and the atlas. The anterior branches of these four form the plexus known as the plexus cervicalis, which is situated opposite the correspond-

ing vertebrae. From this plexus come, besides the muscular branches to the scalenus, the longus colli, etc., the phrenic, which is formed chiefly by the fourth cervical nerve, and which for the most part is

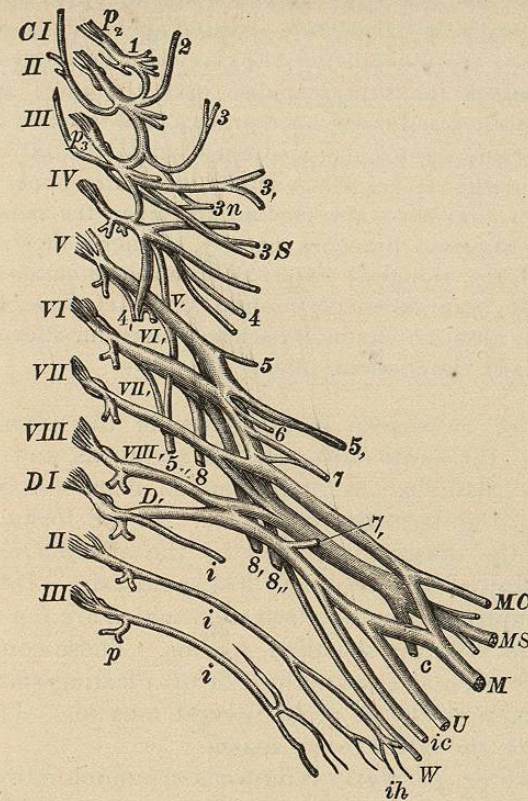


Fig. 93.—DIAGRAMMATIC OUTLINE OF THE CERVICAL AND BRACHIAL PLEXUSES. (After SCHWALBE.) CI-VIII, roots of the cervical nerves. DI-III, roots of the first three dorsal nerves. *pp*, posterior branches—*p*₂, of the second, *p*₃, of the third cervical nerve. 1, anterior branch of the first cervical nerve and loop of union with the second. 2, small occipital nerve. 3, great auricular nerve. 3_s, superficial cervical nerve. 3_n, communicating branches to the descendens noni from the second and third. 3_s, communicating to the accessorius from the third and fourth nerves. 4, supraclavicular nerves. 4_p, phrenic nerve. Brachial plexus: V-VIII, and D, the five roots of the brachial plexus. 5, rhomboid nerve. 5_s, suprascapular. 5_n, posterior thoracic. 6, nerve to the subclavius muscle. 7, 7_i, inner and outer anterior thoracic nerves. 8, 8_s, 8_n, subcapular nerves. MC, musculo-cutaneous. M, median. U, ulnar. MS, musculo-spiral. ic, internal cutaneous. W, nerve of Wrisberg. c, circumflex. i, i, intercostal nerves. ih, intercosto-humeral nerve.

a motor nerve, the superficial cervical, the auricularis magnus, the occipitalis minor, and several communicating branches to the upper cervical ganglion and the gangliform plexus of the vagus (Fig. 93).

The anterior branches of the four lower (the stouter) cervical

nerves, after they have passed between the anterior and middle scalenus and have reached the supraclavicular fossa, form, in conjunction with the anterior branch of the first dorsal nerve, the so-called brachial or subclavian plexus, which may be divided into a smaller or supraclavicular portion situated above, and a larger infraclavicular portion situated below, the clavicle. From the former are given off, besides the suprascapular, only the three subscapular nerves, the anterior and posterior thoracics, and the rhomboid nerve. The larger portion, which has also been called the axillary plexus, furnishes the large nerves which supply the entire upper extremity, the circumflex (axillaris), the median, the ulnar, the musculo-spiral (radial) and cutaneous branches, namely, the nerve of Wrisberg, the internal, and the (longest) external or musculo-cutaneous nerve, which has also been called perforans Gasseri (cf. Knie, Beitrag zur Frage der Localisation der motorischen Fasern im Plexus brachialis, Internat. klin. Rundschau, 1889, 14).

Just as we have seen in speaking of the cranial motor nerves—e. g., the oculo-motorius, the abducens, and the facial—the motor disturbances of the spinal nerves may be of a paralytic or of an irritative character. In the former case the mobility of the muscles supplied by the affected nerve is diminished (paresis) or completely lost (paralysis). In the latter we have symptoms of motor irritation which are not under the control of the will, the so-called spasms. These consist either of transient muscular contractions or of a lasting state of spasmodic contraction of one or of several muscles. The former we call clonic, the latter tonic, spasm.

On the whole, paralytic symptoms are much more common in the distribution of these plexuses than symptoms of irritation.

In the sensory disturbances we can equally distinguish paralytic from irritative conditions, the former giving rise to anæsthesia, the latter to hyperæsthesia. The anæsthesia is characterized by the fact that external (mechanical, chemical, or thermic) stimuli are either not perceived at all or with diminished acuteness, whereas in hyperæsthesia, on the contrary, even very weak stimuli are felt to be abnormally strong and unpleasant. The latter condition is usually attended with symptoms of sensory irritation, manifested by pronounced pains or by paræsthesias—that is, abnormal sensations of pricking, formication, numbness, or a “furry feeling.”

The affections of the sensory fibres of the spinal nerves manifest themselves chiefly by symptoms of irritation. They

are always associated with more or less pain and are called neuralgias. That these also occur in the cranial nerves has already been stated, and the trigeminal neuralgia (cf. page 68) may be taken as a type of them. The neuralgic pains are usually very violent, but are rarely or never constant. They appear periodically and follow fairly accurately the distribution of the affected nerve. The diagnosis is rarely difficult. Peripheral anæsthesias—that is, such as are only due to affections of the peripheral nerves or their end organs—are, as we said, rare.

CHAPTER I.

LESIONS OF THE CERVICAL PLEXUS.

THE cervical plexus is, on the whole, much less frequently affected with motor disturbances than the brachial. Among the nerves belonging to it, it is the phrenic more especially which may present symptoms of paralysis or of irritation; yet neither paralysis nor spasm of the diaphragm due to disease of the phrenic is of any great practical importance, since such an affection scarcely ever occurs by itself, but is much more often met with only when associated with other diseases. Paralysis, for instance, is observed in the course of progressive muscular atrophy, in hysteria, probably also in lead poisoning. Traumatism or mechanical compression produced by tumors or abscesses in the neck may be the cause. Recently it has also been observed in tabes (*Berliner klin. Wochenschr.*, 1893, xvi). Among the signs of paralysis of the diaphragm there is one which is very conspicuous, namely, the faulty expansion in the epigastric region during inspiration. Instead of becoming prominent, as is the case in the normal condition, the epigastrium is drawn in, and when we lay our hand on it we can feel that the diaphragm does not descend. If only one of the phrenic nerves is thus affected this phenomenon is present only on one side, while the other half of the diaphragm performs its function properly. Besides this, hardly any other symptoms are observed in uncomplicated cases if the patient remains at rest, whereas if he exerts himself a distinct dyspnoea and an increase in the frequency of the respirations become apparent. The obstinate constipation which such patients complain of can well be understood if we remember the part which the diaphragm takes in the abdominal pressure.

Spasm of the diaphragm, at least the tonic form of it, is not more common than paralysis. Patients affected with this suffer from great shortness of breath and quickly become cyanosed.

The markedly prominent epigastrium remains with the diaphragm immobile and is tender to the touch, and only the upper part of the thorax shows shallow respiratory movements. In some cases of tetanus, tonic spasm of the diaphragm seems to be the cause of death. It occurs almost never by itself without some accompanying or underlying affection, except in hysterical persons. On the other hand, the clonic form of the spasm, the so-called hiccough (*singultus*), is extremely common. Everybody is familiar with the short clonic movements of the diaphragm, which are accompanied by inspiratory sounds and which vary in frequency and severity, occurring sometimes in such rapid succession that eighty or even a hundred may be counted in one minute. Severe protracted hiccough may become very troublesome, indeed, even dangerous, if sleep is for a long time seriously interfered with. This is, however, only the case if *singultus* occurs as a symptom in the course of other diseases—e. g., in apoplexy, in peritonitis, in chronic gastric catarrh, etc. Even when it appears as a reflex neurosis—e. g., in the course of a chronic gastro-enteritis—it may cause a great deal of trouble to the patient (*Dehio, Berliner klin. Wochenschrift*, 1889, 22). As a rule it is arrested without any interference on the part of the physician by popular methods, such as holding the breath, closing the glottis and then attempting an expiration.

Therapeutics is almost powerless in the face of affections of the motor fibres of the phrenic. In paralysis, electrical stimulation of the nerve, in the (tonic) spasm, chloroform and morphine, have been recommended; yet these measures are by no means reliable.

The sensory fibres which the phrenic takes up in its course, and which are distributed to the pleura, the pericardium, and the peritonæum, may also be affected. Neuralgia of the phrenic is rare, or perhaps we had better say is undoubtedly but rarely recognized. The pains, starting at the base of the thorax at the points corresponding to the insertions of the diaphragm and radiating in all directions, are taken for rheumatism of the chest muscles or intercostal neuralgia, and it is only in cases in which the pain is felt directly over the *scalenus anticus* and corresponds to the course of the nerve that the diagnosis is made correctly. *Valleix's* painful points can occasionally be demonstrated on the spinous processes of the upper cervical vertebræ and at the points of insertion of the

diaphragm. Respiration is interfered with only when the mobility of the diaphragm is at the same time impaired.

The ætiology of the disease is obscure; more especially are we ignorant of the conditions under which it may occur independently. It seems not to be a rare accompaniment of Graves' disease, of angina pectoris, and of sclerosis of the coronary arteries.

Another apparently more important neuralgia in the region of the cervical plexus is the occipital or cervico-occipital neuralgia, which attacks by preference the occipitalis major, but also the minor, further the auricularis magnus, the subcutaneus colli and the tympanic nerve or plexus, which belong to the glosso-pharyngeal nerve (Jacobson's anastomosis). The patients complain of pain in the whole occipital region, in the neck, often, too, in the ears. Much more rarely the pain radiates in a forward direction to the cheek and the lower jaw. The so-called otalgia nervosa may give rise to such excruciating pains that the patient's consciousness may become clouded (Gompertz, *Centralblatt f. d. ges. Therap.*, 1890, Heft 5), and very severe pains may also be produced by an affection of the tympanic plexus. In such cases it is important to examine for ulceration around a tooth or in the larynx. Such patients dread every motion of the head, and carefully avoid every cause for laughing, as this, as well as sneezing, chewing, and so forth, is liable to bring on an attack. The consequent rigid position of the neck is quite characteristic for this form of neuralgia. Painful points can sometimes be found at the exit of the occipitalis major—that is, about halfway between the mastoid process and the spinous processes of the cervical vertebræ. Where they are absent the disease may be confounded with torticollis rheumatica; yet such a mistake may be avoided by remembering that the neuralgia is not constant, but characterized by intervals of perfect ease.

The course of an occipital neuralgia is often tedious, but on the whole it is not unfavorable, and complete cures are not rare. The prognosis is bad only when there exists some organic lesion of the nerve, caused, for instance, by disease of the cervical vertebræ. If, as is usually the case, no definite cause can be found, energetic counter-irritation to the skin, local bleeding, galvanization, the application of moist or dry heat, or the use of antipyrin or phenacetin, will usually effect a cure or at least an improvement. Subcutaneous injections

of morphine we shall probably in most cases be able to dispense with. The removal of every deleterious cause should, of course, be insisted upon. Under certain circumstances the occupation has something to do with it. Thus, I have found that the stevedores of the London docks, who carry extremely heavy weights on their backs which press upon the neck and the occiput, are frequently subject to occipital neuralgia (cf. Hirt, *Krankheiten der Arbeiter*, iv, 91).