CHAPTER IV.

THE DISEASES OF THE TRIGEMINAL NERVE.

The trigeminus, the stoutest of all the cranial nerves, leaves the brain by two separate roots—an anterior small, exclusively motor, and a posterior larger, the sensory portion. Its point of exit is situated at the base of the pons, where the transverse fibres of the latter are prolonged into the middle peduncle of the cerebellum. Both roots lie in close apposition, and pass into a recess—the cavum Meckelii—formed by the dura mater, and situated over the inner end of the superior surface of the petrous portion of the temporal bone. Here the posterior root forms a somewhat crescentic swelling—the Gasserian ganglion—from which pass forward the three somewhat flattened divisions, the ophthalmic and the superior and inferior maxillary nerves, the last being joined by the smaller motor root. These three branches leave the interior of the skull by the sphenoidal fissure, foramen rotundum, and foramen ovale, respectively.

The trigeminal nerve possesses two nuclei—a motor and a sensory one. The first—the smaller—is situated in the outer part of the tegmentum, and its ganglionic cells are characterized by their relatively large size (60 to 70 μ in the greatest diameter). The larger—sensory—nucleus lies external to the motor; in its collection of gray matter there are found very small ganglionic cells (20 to 30 μ in diameter).

With regard to the origin of the two roots there exist very different views, and but little is definitely known about the subject. It can not be doubted that the motor root springs from what has been decided upon as the motor nucleus, nor that there exist a number of small bundles of fibres which arise high up in the region of the anterior quadrigeminal body, and descend outside the aqueduct to the level of the exit of the fifth nerve, where they help to form the motor root. This is the so-called descending anterior, or, as Henle terms it, superior root, the section of which, a crescentic, externally convex, internally concave figure, at once strikes the eye in frontal sections of the pons (cf. Fig. 8, Vd). That the sensory

root arises from the above-mentioned sensory nucleus is probable, but not certain. On the other hand, it must be remembered that as low down as the neighborhood of the second cervical nerve there can be demonstrated in the caput cornu posterioris a layer of longitudinal medullated fibres, the highly characteristic transverse section of which, crescentic in shape, may be followed upward, as it gradually increases in size, as far as the level of the exit of the trigeminus. Suitable longitudinal sections plainly show that this longitudinal bundle forms a large part of the sensory root of the nerve. This is the so-called large ascending root of the fifth, the position of which

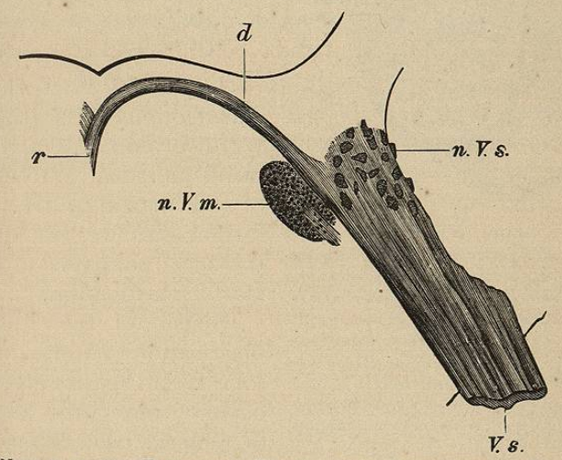

Fig. 10.—NUCLEI OF THE TRIGEMINAL NERVE. (After SCHWALBE.) *n. V. s.*, nucleus of the sensory. *n. V. m.*, nucleus of the motor root. *d*, fibres passing to the raphe. *V. s.*, sensory root.

in transverse section is represented in Fig. 11. The cortical area of the trigeminus is not definitely known as yet; still, from experiments on animals, as also from the few clinical observations which we possess, there is reason to conclude that, at least so far as the motor portion of the nerve is concerned, it is located in the region of the anterior portion of the fissure of Sylvius; as regards the sensory portion we know nothing.

We shall divide the affections of the trigeminus into central and peripheral. In the first class we recognize cortical and bulbar diseases; in the second class we have to deal with either intra- or extra-cranial lesions. The trigeminus being a mixed nerve, containing in by far its larger portion only sen-

sory, but in its third branch important motor fibers, we are obliged, as there may exist in any case conditions of irritation or of paralysis, to distinguish clinically between hyperæsthesia (neuralgia, neuritis) and anæsthesia of the sensory part of the nerve, and between hyperkinesis (spasm) and akinesis (paralysis, paresis) of the motor portion.

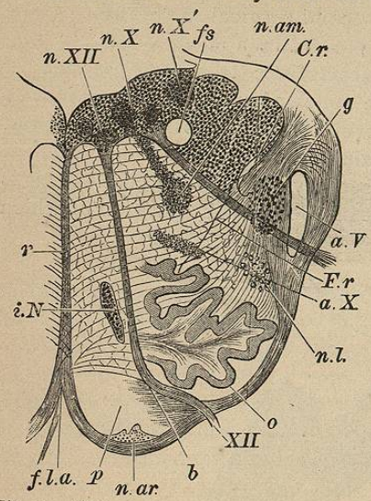

Fig. 11.—Cross-section through the Medulla Oblongata. (After Schwalbe.) *a.V*, ascending root of the fifth. *n.XII*, nucleus of the hypoglossus. *n.X* and *n.X'*, nucleus of the vagus. *XII*, hypoglossal nerve. *fs*, solitary funiculus (respiratory fasciculus). *p*, pyramidal tract. *o*, olive. *i.N*, pyramidal nucleus. *f.l.a.*, anterior longitudinal fissure. *n.am*, nucleus ambiguus.

I. The Central Affections of the Trigeminus.

In dealing with the cortical affections of the trigeminus we discriminate between irritative and destructive lesions of the cortical centre. In the former case we get spasm, in the latter paralysis of the muscles of mastication.

Spasm of the muscles of mastication (trismus, masticatory facial spasm—Romberg) occurs frequently as a part of general convulsions (Senator, Petrina, Seligmüller), and much more rarely independently, unaccompanied by other spasms (Lépine, von Pfungen, Langer). There are two forms: a tonic, in which the teeth are pressed firmly together and the muscles of mastication, usually of both sides, are hard as wood to the touch; and a clonic, in which the lower jaw is moved to and fro horizontally or vertically, and spasmodic masticatory movements are induced. In a case in my practice, in an old gentleman who had suffered from repeated slight apoplectic attacks, the patient for several hours every day goes through well-marked chewing movements without eating anything, which at times are so vigorous that he often while smoking bites through his cigar unintentionally. The origin of the disease is often of a reflex nature. Toothache, periostitis of the inferior maxilla, or face-ache may give rise to it. Sometimes, it may be, a cortical affection lies at the bottom of it, but for

this there is at present no evidence furnished by post-mortem examinations.

Paralysis of the muscles of mastication is, on the whole, less frequently observed than spasm. Barlow, Oulmont, and Kirchhoff report cases of it, recording in some only cortical lesions, but in others changes in deeper-lying portions of the brain as well. All the cases had this one anatomical feature in common, viz., that the cortical lesions always occurred bilaterally, thus in every case involving both centres. The first instance in which a unilateral lesion of the cortex was found was published by myself (cf. lit.). It confirms the supposition that the cortical motor area of the trigeminus includes the lower third of the anterior central convolution and the adjoining portion of the second and third frontal convolutions, and demonstrates that a unilateral lesion of the cortex (in this case it was left-sided) is sufficient to paralyze the muscles of mastication on both sides. The lesion was due to the presence of a psammoma the size of a filbert, which was situated upon the dura and cortex at the spot indicated, causing a depression and softening of the latter. The paresis of the muscles of mastication had reached a high degree, and was the more interesting from the fact that it was accompanied by periodical attacks of pain in the face and spasm in the area of distribution of the left facial nerve. Paresis and paralysis of the muscles of mastication are occasionally observed among the symptoms due to progressive bulbar paralysis and to pseudo-bulbar paralysis. The idea that these may develop as the result of a peripheral affection in an isolated disease of the motor portion of the third part of the trigeminus can not *a priori* be considered as impossible, but there have been up to the present no such cases observed. The differential diagnosis between a central and peripheral affection could be made only by means of an electrical examination. The lesion is central if there are neither quantitative nor qualitative changes in the reaction to the faradic and the galvanic currents. If such changes, however, exist—for instance, if there be the "reaction of degeneration"—the lesion is peripheral.

Only the latter form of the disease is amenable to treatment (by electricity), and then with but slight chance of success. Against the central variety we are absolutely powerless. With regard to the affection of the nuclei and roots of the fifth nerve in the pons, the anatomical relations of which are, as we have seen, not as yet sufficiently well understood, we know little

or nothing. Whether they ever occur independently, or, as is more likely, only as concomitants of diseases of other bulbar nerve centres, has not been determined. However, the supposition seems justified that the centres in question, in the course of certain general diseases of the nervous system—for instance, in multiple sclerosis and particularly in tabes—are affected relatively early. Thus Erben reports (Wiener med. Blätter, Nos. 43, 44, 1886) that he has observed very troublesome paræsthesias of the sense of taste in tabetics occurring in paroxysms, beginning in the pharynx. These were especially pronounced at the anterior edge of the tongue, and were accompanied by anæsthesia in the second branch of the fifth. This condition is presumably to be considered a disease of the nerve of taste, being analogous to the so-called gastric crises which are attributed to an affection of the vagus centre. A central anæsthesia of the trigeminus may also occur. In its symptoms it would not differ from the peripheral except that it may be bilateral. The central nature of the trouble one would infer from the simultaneous participation of other nerves, both sensory and motor (Romberg). The interference with conduction may take place at the base of the brain.

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II. Peripheral Affections of the Trigeminus.

In its peripheral part the nerve may become diseased inside as well as outside of the cranium. If the lesion is one of the stem, and extends to all three branches, it may be difficult, indeed impossible, to determine its exact site, because we do not as yet possess any means which enable us to definitely decide whether the nerve is diseased centrally from the Gasserian ganglion, whether the ganglion itself, or, finally, whether the

three individual branches are all affected at their exit from the skull.

An affection of the nerve stem to the central side of the Gasserian ganglion can only be assumed with any degree of certainty if the nerve is diseased in its whole sensory distribution and if extensive trophic disturbances are also present. The affections of the Gasserian ganglion itself (inflammation, neoplasm, softening) have as yet but little practical importance. If the disease does not take in the stem, but only the terminal portions of the individual branches, it is easy to determine the seat, and while we have in the intracranial diseases to consider those of the finer branches of the nerve in the dura, in the extracranial we have the branches distributed to the face and those to the nasal cavity.

A. Intracranial Diseases.

Headache—Cephalalgia.

Since it is very likely that there are only exceptional cases of idiopathic headache in which the fifth or its terminal branches in the dura (cf. page 3) are not implicated, it seems advisable to speak of headache here. At the same time we must expressly state that we are forced thus to take up different diseases together, which are ætiologically as well as pathologically to be strictly separated from one another.

The main point to decide in a given case will always be whether the headache is to be regarded as merely a symptom of another disease or as an affection by itself. Nobody ever would assume a headache which occurs at the onset of a severe illness—for instance, an acute infectious disease, or in association with organic brain disease (e. g., tumor), or during grave disorders of nutrition, anæmia, and chlorosis—to be an affection by itself and treat it as such. These headaches will always be considered as a mere symptom of the underlying disease; but when we find an otherwise healthy person suffering from protracted or paroxysmal headache, while on repeated careful examination we are unable to discover any other disease, then we are forced to assume an independent affection and we have to endeavor to determine the following points: (*a*) The seat of the headache; (*b*) its peculiarities and its course; (*c*) its ætiology; (*d*) its appropriate treatment.

(*a*) The anatomical situation of the headache can hardly

ever be determined; but we are justified, since we do not know what part the brain substance takes in it, in believing that the sensory terminal branches of the trigeminus in the dura (the dura receives at least two branches from the trigeminus) are always implicated, and are thus in some measure the seat of the headache. Under what conditions these nerve endings are thrown into a state of irritation—a state upon which the headache depends—is not well understood, and all we know about this question is more or less hypothetical. The most probable explanation is that the amount of blood in the brain or its membranes at the time being is an important factor in the production of the morbid condition, whether there be a permanent increase or decrease or frequent, perhaps very slight, changes in the amount. An increase constitutes what is called cerebral hyperæmia, a decrease cerebral anæmia; and we assume the former condition if full-blooded individuals, who are liable to rushes of blood to the head, complain of paroxysmal headache; the latter, if it occur in pale, anæmic patients who are subject to fainting spells. However, we do not know anything positive, and we shall have occasion to deal more in detail with this in another place. Of the greatest interest, and perhaps of the most common occurrence, are the fluctuations in the intracranial blood pressure, which possibly are the cause of the irritation of the terminal branches of the trigeminus in the dura and pia. If such fluctuations appear frequently, so as to give rise to an unequal distribution of the blood in the two halves of the brain, the irritability of the sensory endings may become abnormally increased, so that slight causes are sufficient for the production of the pathological condition. The clinical observations even go to show that without any demonstrable cause from time to time there may develop an increased irritability of these terminal branches of the fifth, associated with simultaneous fluctuations in the blood pressure. If the attack of headache thus produced is accompanied by vaso-motor symptoms, either of a paralytic or of an irritative nature, it is designated as migraine or hemicrania, the latter name being given to those not very common cases in which the pain is strictly confined to one side of the head. Owing to the vaso-motor disturbances just mentioned, some have been inclined to locate the seat of the disease in the sympathetic system, without being able, however, to show that the symptoms referable to the sympathetic are not perhaps only a secondary result of the pain, and therefore reflex

in nature (Möbius); and until this is actually demonstrated not to be the case we are justified in looking upon migraine as belonging to the affections of the trigeminus. In some, as it seems, quite exceptional cases, the seat of the headache is to be referred to certain muscles, which present at their origin and insertion as well as in their course points of tenderness. Among these, besides the frontal occipital and temporal muscles, are the sterno-cleido-mastoid and the upper part of the trapezius. This myalgia, which is occasionally produced by an unnatural position during sleep, and which is easily diagnosticated on careful examination, is said under certain circumstances to be the cause of headache.

(*b*) With regard to the peculiarities and the course of the headache connected with the affections of the trigeminus, we know that in its character as well as in its situation it presents no inconsiderable number of variations: thus, while one patient complains of a dull, boring ache, another describes his pain as sharp and burning; while in the one it is worse in the forehead, another refers it chiefly to the occiput, vertex, or temples, etc. In some instances the patients designate sharply circumscribed places of the hairy scalp as the seat of their pain. The headache also varies much in degree—from a dull sensation of pressure to a pain which allows of no sleep. In some cases the suffering is increased by a touch or a tap on the head, while in others it is soothed by a firm bandage around the temples. Seldom do we find a headache lasting for days, weeks, or even months without interruption; usually there are times when it is less severe or when it ceases completely. There is no regularity or uniformity in the occurrence or duration of the attacks. Two cases are scarcely ever alike, and almost always each presents certain peculiarities of its own: thus in the one, slight febrile movements, absent in another, may occur; one patient enjoys a splendid appetite during the most violent pain, while another is unable to eat a thing, etc.

(*c*) Ætiologically, heredity plays a certain *rôle*, though this is far less important than in the case of migraine. Frequently the parents of the patient, especially the mother, have from their youth up suffered from headache without attaching much importance to it or consulting a physician for it. Mental overwork in young people is sometimes a factor, and rapidly growing youths not infrequently suffer from headache (cephalæa adolescentium). In anæmic and chlorotic conditions, in chronic

dyspepsia, after acute alcohol intoxication, headache is of common occurrence; it may also be caused by diseases of the pharynx and the middle ear (Legal). The ætiological importance attributable to errors in accommodation or refraction has been pointed out by Bickerton. Certain poisons, if introduced into the body for a long period of time, lead to habitual headache—e. g., lead, tobacco, and others; the headache found in lues and malaria in all probability also belongs under this category. The reflex origin of headache due to affections of the nose and the sexual organs, especially the uterus, has only of late years been sufficiently appreciated. It is most important that the nose should be carefully examined for swellings (Bresgen, Münchener med. Wochenschr., 1893, No. 5).

In exceptional cases migraine-like attacks are met with in cases of gout, and it would appear as if they were also in some way connected with the excretion of uric acid, since it has been found that before the attack no uric acid can be detected in the urine, while after it the amount is very perceptibly increased, and later on for a time markedly diminished. The polyuria, which occurs frequently after the attack and lasts for several hours, with an acid urine, light yellow, almost as clear as water, of a very low specific gravity (1.005 to 1.007), has been mentioned before. To the fact that migraine-like attacks may also occur in the initial stage of tabes and may be of importance for the diagnosis and prognosis, we shall have to refer later.

It is difficult, indeed at times impossible, to give a reliable prognosis in the cases now under consideration. So far as life is concerned, it is always favorable, if the case is of a purely functional character—where the headache exists by itself as an independent affection, and where it is not to be regarded as a symptom of organic disease. The patient recovers from his severest attacks comparatively readily, and even after frequent repetitions of them it is exceptional that the digestive disturbances and the loss of strength which these entail induce a really serious condition.

But is the prognosis for recovery as good as for life? To this question we must answer without reservation, No. One can not deny that the outlook for a complete recovery is, on the whole, very bad, and that the chances, *cæteris paribus*, are so much the worse the longer the affection has lasted, and the more difficult it is to find any tangible cause for its occurrence.

The worst cases are those in which the trouble is inherited; in these recovery is very exceptional. At any rate, the prognosis in all cases should be guarded, and little should be promised. There is hardly any other condition which is so liable to injure the physician's authority and the patient's faith in him and his medical skill as migraine and habitual headache. On the other hand, spontaneous recoveries are not unheard of—a fact which we ought to remember, if all our drugs leave us in the lurch.

(*d*) The treatment of habitual headache is generally very tedious, and puts to a severe test the perseverance not only of the patient but also of the physician. It is therefore absolutely necessary, before undertaking to take charge of a patient of this kind, to lay down, after a most careful and minute examination, a definite plan of treatment, which must be rigorously adhered to. It is not sufficient to use to-day one drug and to-morrow another, of which we have possibly read in the last journal as being effectual against headache, and with which we may accidentally obtain a transient good result. The treatment must rather be systematic, and the outcome of certain well-considered conclusions, which we shall now briefly discuss. In the first place, we have to decide whether there exists some underlying disease which causes the headache. If, as is frequently the case, stomach symptoms are present, a stay at Carlsbad or Kissingen may do much good. If the acidity of the gastric juice is increased, the regular ingestion of alkaline drinks or of lukewarm water is indicated. In all cases much attention is to be paid to the diet, and the patient should especially be warned against overloading his stomach at night. The regulation of the bowels is effected by massage or the use of large enemata of water, or of small injections of pure glycerin (5 to 6 cc.—ɱ lxxx to c.—at a time), or by vegetable aperients, such as rhubarb. Any degree of constipation may be attended with bad consequences. Diseases of the middle ear or of the pharynx should be treated by a specialist. If the patient have a gouty diathesis, the use of lithium and the regulation of the diet should constitute the main treatment. The eyes should be examined for any possible errors of accommodation or refraction that may exist, and these, when found, should be corrected by means of proper glasses. Cases which had resisted all other treatment have been cured in this manner (Bickerton, Brailey, Weir Mitchell, and others).

If no coexisting disease can be detected, our chief efforts

must be directed to building up the general constitution. From the cold-water treatment, general faradization (according to Beard and Rockwell), franklinization with the Holtz machine, systematic gymnastic exercise at home—from any one of these measures we may, under certain circumstances, obtain the desired result. In some cases lasting advantage has been seen from a change of climate, from travel, and a stay in the mountains or at the seaside. With regard to the combating or the shortening of the attacks, antipyrine, 1.0 gm. (15 grs.) at a dose, or 3 to 4 gm. (45 to 60 grs.) a day, or phenacetin, 0.25 gm. (4 grs.) at a dose to 1.25 gm. (20 grs.) a day, may be given. The exhibition of these drugs is frequently followed by good results, although this is rarely lasting. If vaso-motor changes point to the existence of a pathological contraction or dilatation of the blood-vessels, we may in the former case—in that of contraction—resort to the careful administration of nitrite of amyl, three to five drops of which are put on a handkerchief and given the patient to inhale ; or to the internal use of nitroglycerin (one drop of a one-per-cent alcoholic solution three times a day). Great care has to be exercised in the exhibition of the latter drug, and, if the pulse indicate it, we ought to begin with minimum doses. Such a precaution is more especially necessary if the pulse is full and the arterial wall tense, in which case a quarter or half a drop is sufficient as an initial dose (Trussewitsch). It is, moreover, not advisable to continue its administration any longer than one or two weeks, as it is liable to give rise to cerebral symptoms (buzzing in the head, vertigo). In the second case—that of vaso-dilatation—ergot is indicated, which may either be used in the form of hypodermic injections of ergotin (ergotini dialysati, 1.0—grs. 15 ; aquæ destill., 4.0—℥ j. Sig.: Half a syringeful); or by the mouth (extr. secal. corn. (Denzel), 2.0—℔ xxx ; aquæ cinnamomi, 180.0—℥ vj. Sig.: A tablespoonful every two hours). If no such indications are furnished by the condition of the blood-vessels, we have to try which medicine will do the most good, and may begin with the citrate of caffeine (0.15—about two grains—three times a day), which we have found to be effectual. The pasta guarana, 2.0 grm. (grs. xxx) twice a day, gives similar results, but often interferes with digestion. Salicylic acid is in many cases, especially at the onset, followed by surprising results, but its continued use is disagreeable to the patient on account of its bad after-effects. Application to the

painful spot of an alcoholic solution of menthol (three to twenty) is often both agreeable and refreshing to the patient, the migraine pencils, also prepared with menthol, having a similar effect. This, according to Goldscheider, gives rise to a hyperæsthesia to cold which is associated or followed by a diminution in the excitability of the sensory nerves. If painful points can be discovered on the scalp or on the muscles (*vide supra*), a slight pressure and kneading of the same, later a more energetic massage to the head, is advisable.

Electricity may be used (1) in the form of a constant current passed longitudinally or transversely through the head or by applying it to the cervical sympathetic, and (2) in the form of the faradic current. In this case it is best for the physician to apply his own hand, previously moistened, to the forehead of the patient, this taking the place of one electrode. In the other hand he holds one of the electrodes, the other being placed on the back of the patient's head, the sternum, or some other indifferent point. With this mode of application, which is called the "faradic hand," only very mild currents should be used (cf. Hirt, Lehrbuch der Electrodiagnostik und Electrotherapie, Stuttgart, Enke, 1893).

Numerous as are the means at our disposal for combating the disease, quite as numerous are the patients who, after hundreds of unsuccessful trials, give up all medicines and all physicians. They retreat at the beginning of the attack from the world and from their families, darken their rooms, lie down quietly, and take simple domestic remedies, among which Russian tea with lemon juice has obtained a prominent place. Absolute rest is what always does most good to all these patients. Finally, we should not forget to deprecate, especially here, the use of all hypnotics, more particularly morphine, as they never do any good, and are often capable of producing serious harm.

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