

increase in the frequency in the number of beats. In other words, the primary irritation has given way to paralysis of the vagus.

Together with the action of the heart, respiration is affected. During coma it is deep, slow, and often stertorous; with the continued increase of the cerebral compression it becomes irregular and shallow. Deep inspirations are interrupted by long pauses, in one of which the patient dies.

Slight vertigo, sometimes attended with vomiting, is not uncommon. The latter, which is cerebral in origin, has certain peculiar characteristics. It usually occurs on the slightest provocation. It may be provoked by a simple change in the position of the body, and often comes on in the early morning and without the existence of any stomach trouble. Without any retching large amounts of watery clear stomach contents are repeatedly thrown up, and after a short while the patient feels perfectly well. Sometimes the vomiting is the forerunner of apoplectic attacks, in which the patient may be unconscious for hours. Such attacks are due to a sudden increase in the intracranial pressure, either from hæmorrhage into the substance of the tumor or from sudden hydrocephalic exudations (Wernicke).

That papillitis is extremely common in brain tumor we have said before. We may add here that it may exist without headache, for the increase in the intracranial pressure sufficient to produce papillitis does not necessarily produce an appreciable irritation of the dura, and, on the other hand, if headache exists without papillitis, it is not referable to the cerebral compression but to irritation of the dura. We should never forget that papillitis may exist without any visual disturbance, and hence never omit the ophthalmoscopic examination in suspicious cases, no matter whether the patient complains of trouble with his eyesight or not. Again, the patient may only complain of one eye, while the other seems to perform its function normally, and yet profound changes be found in either fundus.

If in the course of a brain tumor the patient develops in addition to papillitis an early blindness, then the amaurosis has to be interpreted as a focal symptom, and the tumor located in the cerebellum, as neoplasms in this situation are usually attended with very marked internal hydrocephalus, especially of the third ventricle, the floor of which becomes distended and

presses upon the chiasm situated under it (Türck). Moreover, early amaurosis may be produced by tumors in the region of the corpora quadrigemina, especially those of the pineal gland, by basal neoplasms, which, just as those of the pituitary body, press on the chiasm and the beginning of the optic tract, or which raise the base of the brain from the base of the skull, so that the artery of the corpus callosum is made tense and compresses the optic nerve (Türck).

The visual disorders which occur in the course of brain tumors have been grouped in the following manner by Hirschberg (*Neurol. Centralblatt*, 1891, 15):

(1) Attacks of blindness—epileptiform amaurosis. (2) Permanent visual disorders:

A. Produced by changes in the brain: *a* Homonymous hemianopia (destruction of one or both visual centres in the occipital lobe). *β* Crossed hemianopia (tumors in the region of the anterior or posterior angle of the chiasm. *γ* Bilateral hemianopia—total amaurosis.

B. Produced by changes in the eye-ground: *a* Enlargement of the blind spot (not noticed by the patient). *β* Narrowing of the field of vision. *γ* Diminution of the central acuteness of vision, due either to anatomical changes in the retina or to interruption of the nerve-fibres leading to the retina.

In considering the focal symptoms produced by brain tumors we must first of all state that these may be entirely absent, just as we have seen is sometimes the case in brain abscess. Instances of this kind have repeatedly come under observation, and it was on this very account found impossible to make a certain diagnosis during life. Absence of both general and focal symptoms is very rare, and only possible when the new growth is very limited, and situated at an indifferent place. Further, there are symptoms which we are justified in taking for focal symptoms, but which are in reality due to the general compression. The most important one of this nature is hemiplegia. We may in a case of brain tumor find a well-marked hemiplegia, which persists without any amelioration, and be induced to call it a focal symptom, and yet, to our surprise, at the autopsy a tumor may be found in an entirely indifferent area—for instance, in the white matter of the frontal lobes—a connection which we could not reckon upon. An in-

stance of this nature I had published in an inaugural dissertation. This was the case of a man fifty years of age who suffered from mitral insufficiency, and who was seized with a grave right-sided hemiplegia which persisted unchanged for months, associated with speech disturbances. Papillitis could never be demonstrated. The case was then supposed to be one of embolism in the left middle cerebral artery, but at the autopsy a round-cell sarcoma the size of a walnut was found in the white matter of the frontal lobe, in the pars frontalis media of the left hemisphere (Steinberg, Beitrag zur Localisation der Hirntumoren, Inaugural Dissertation, Breslau, 1886). For the hemiplegia to be uncrossed—that is, to be situated on the same side as the tumor—is certainly very exceptional; in our case it was crossed. If focal symptoms make their appearance comparatively early, we mostly have to do with basal tumors which produce fatty degeneration and gray atrophy of the involved cranial nerves, notwithstanding the no inconsiderable power of resistance which such nerves possess. Besides the optic (unilateral papillitis) and the oculo-motor (ptosis), the fifth, the facial, the abducens, and the hypoglossus are then relatively frequently affected. Of the fifth, usually only the sensory portion is implicated; sensory disturbances in the face, *tic douloureux*, later anæsthesia in its area of distribution, occur much more frequently than paralysis of the muscles of mastication. The facial is, on the contrary, affected in its whole distribution—a fact which, in conjunction with the reaction of degeneration in the paralyzed muscles which also exists, is characteristic of the peripheral origin of the paralysis (cf. page 89). The whole hypoglossus is involved, which causes not only the tongue to be protruded to one side, but also leads to atrophy in the affected muscles; swallowing, mastication, and speech are necessarily affected. The hypoglossus paralysis, however, is much rarer than that of the facial. Combined affections are found:

(a) Of the olfactory, the optic, the oculo-motor, and the first branch of the fifth in tumors of the anterior fossa.

(b) Of the chiasm, the oculo-motor, the first branch of the fifth, and the abducens in tumors of the pituitary body.

(c) Of the oculo-motor, the patheticus, the chiasm, in tumors of the middle fossa, if situated above the dura, of the three ocular nerves and the fifth, if situated below the dura; and, finally,

(d) Of the facial, the trigeminus, the auditory, the glossopharyngeal, the vagus, the accessorius, and the abducens in tumors of the posterior fossa.

Diagnosis.—It is the object of our diagnosis in a given case to determine first the presence, then the position, and finally the nature of a tumor. The first question can, as is apparent from what has been said, by no means always be answered with certainty; especially is this difficult if either only general or only focal symptoms are present. Among the former, headache, we have said, plays the most important rôle. It may last for years without any other signs to lead us to suspect a tumor, and it is in such instances that we can easily understand how this may be mistaken for simple habitual headache or hemicrania, where the pain may also attain an almost unbearable intensity. Yet in hemicrania and its allied affections there occur remissions, and there are considerable periods of time during which the patient is perfectly free from pain; whereas in the course of a brain tumor this never happens. Here we find no intervals of relief, but the patient's sufferings are uninterrupted. Moreover, a headache, no matter how severe it be, which is materially improved by the exhibition of salicylates, bromide, or caffeine, etc., we can hardly refer to a serious organic brain disease. If, however, it persists uninfluenced by all the ordinary therapeutic measures, this ought to put us on our guard, and make us look further for focal symptoms—unilateral papillitis, for instance—which may be present; yet we should, on the other hand, not lose sight of the fact that there are quite a considerable number of cases of pure migraine which do not yield to remedies, and which have to be regarded as incurable.

Convulsions, although less often than headache, may be the only striking symptom. If they last for months, appearing at moderately long intervals, we may, in the absence of any other symptoms pointing to a tumor, think of idiopathic epilepsy. Here, also, the therapeutic test may throw light upon the subject. Large doses of bromide usually diminish the frequency as well as the severity of epileptic attacks, at least for a time, and the favorable influence of the drug is often, indeed, quite striking; while if the seizures are due to an organic cerebral lesion, bromides, even if they be continued for a lengthened period, have but little effect. Such fruitless trials should direct our attention again to the possible existence of a tumor,

and lead us to search for further symptoms which may help the diagnosis.

If the patient complains of nothing further than attacks of vertigo and vomiting, if psychical changes, headache, and convulsions are absent, then the diagnosis remains uncertain, because vertigo can be produced by many different causes, and cerebral vomiting is met with in affections so different from one another that it is simply impossible to diagnosticate a brain tumor from these two symptoms alone. They even do not necessarily indicate a brain disease, as we may have to deal with Ménière's complication of symptoms, with a stomach-neurosis, or a spinal disease—e. g., tabes. The gastric crises of the tabetics may resemble very closely the attacks of vomiting in the course of a brain tumor.

Among the organic diseases of the brain which may be mistaken for a new growth are brain abscess and meningitis. The former—the abscess—is almost always associated with febrile movements, and rarely with papillitis; moreover, there are the characteristic remissions, so that the patient's general condition may be excellent for years. If we keep these points in mind, and if we make it a rule never to diagnosticate a brain abscess unless we can obtain in the history some ætiological datum, such as an otitis media, traumatism, etc., the differential diagnosis will usually present little difficulty. In meningitis, fever is the most important symptom. Papillitis is more frequent here than in abscess, and hence of less value in the differential diagnosis between tumor and meningitis, yet the early delirium and the jactitations are sufficiently characteristic symptoms to be of diagnostic value.

Other diseases to be considered are chronic cerebral sclerosis associated with arterial disease, and lobar sclerosis. The absence of grave general symptoms, the usually much slower course, the appearance of multiple sclerotic foci, the absence of papillitis, are often points enough on which to base a diagnosis.

Finally, the possibility of confusing brain tumor with progressive paralysis of the insane (dementia paralytica) and with chronic alcoholism ought to be spoken of. This can, of course, only happen in those cases of brain tumor where apoplectiform attacks occur, where headache is either absent or only slight, where, however, the mental disturbances are marked, and where, owing to the defective memory, the alterations in speech become a prominent feature of the case. The course

will clear up all doubtful cases. If we are dealing with a dementia paralytica we shall not have to wait long for the appearance of the characteristic delusions of grandeur, and the patient will become bewildered and have transitory periods of excitement, whereas, with the tumor, stupor and somnolence are developed. In chronic alcoholism tremor and the occurrence of stomach and liver affections are usual. Above all, a conscientious use of the history will guard us from an error in the diagnosis.

The seat of the tumor we can only attempt to determine when we have reliable focal symptoms to aid us, but, as we have observed, such may be absent, and, as it seems, this is more especially the case in soft tumors occurring in the ventricles and sometimes in the frontal lobes, which give rise to symptoms of general compression only; even tumors of the fourth ventricle are by no means necessarily associated with well-marked and characteristic symptoms, so that often only a probable diagnosis is possible (Josef, *Zeitschrift f. klin. Med.*, 1889, xvi, 3, 4). It is furthermore perfectly certain that a great part of the basal ganglia, the lenticular and the caudate nucleus, also the anterior portion of the thalamus, the corpus callosum, the fornix, the choroid plexus, and finally the cerebellum, with the exception of the vermiform process, may be the seat of neoplasms with a complete absence of all focal symptoms. On the other hand, tumors of the motor area, of the occipital and temporal lobes, of the pulvinar, of the crus, the pons, the medulla oblongata, and of the vermiform process of the cerebellum, often manifest themselves clinically by characteristic focal symptoms, which we here need not describe, as they have been considered above in detail. Wood (*Univers. Med. Magazine*, 1889, April, No. 7) reports a case of tumor in the temporal lobe running its course without giving rise to symptoms. Suffice it only to add that destruction of the pulvinar, no less than destruction of the occipital lobe, may give rise to hemianopia, that an early oculo-motor paralysis points to the existence of a tumor in the crus, while severe general symptoms—tonic convulsions, without the loss of consciousness, staggering gait—indicate a neoplasm in the vermis of the cerebellum. Tumors of the medulla oblongata may, if general symptoms are absent, simulate bulbar paralysis in their course. Vertigo has often been noted in connection with such tumors. Other symptoms are changeable and uncertain; sometimes, indeed, there are no

symptoms at all. Paralysis of the abducens points to the posterior fossa as the seat of the neoplasm. The affections of other nerves, which are important in this connection, have been mentioned above.

Where we have amaurosis, the pupillary reaction to light ought to be carefully examined. Its presence denotes that the optic nerve and tract are intact, and the new growth can only be situated in the central optic fibres, while if it is absent or much diminished we have to deal with a lesion of the optic nerve or tract. Even with the existence of papillitis the pupillary reaction may be present. Then the occurrence of the former with the central lesion must be considered as an accidental coincidence. If we think it possible that the amaurosis is due to double hemianopia, we may examine for the so-called hemianopic pupillary reaction (described on page 35) to throw light upon the question.

The existence of focal symptoms, however, does not always facilitate the diagnosis as much as we might suppose. This is especially true if the general symptoms are very grave and pronounced. As we have remarked, a hemiplegia must not always be taken for a focal symptom, and we must again insist that its presence is of no value for the topical diagnosis. We need not mention that various disturbances may be produced by indirect action which baffle all attempts at a topical diagnosis (cf. the lecture of Jastrowitz, the reference to which is given at the end of the chapter).

The nature of the tumor can in some cases not be determined, while at other times it may be very apparent. The course of the disease is of less value in this question than, for example, the history of the patient's previous diseases; and the fact that certain tumors show preference for certain portions of the brain, sometimes also the age of a patient, are likely to afford us valuable hints.

Where syphilis has existed, we have to think of gummata. If the family history be one of tuberculosis or carcinoma, brain tubercles or secondary carcinoma ought to be considered. A chronic cerebral affection in a child, attended with headache and convulsions, is strongly suggestive of solitary or of multiple cerebral tubercles. Tumors of the cortex are more likely to be of a syphilitic or tuberculous nature, while those of the base are preferably sarcomata; those of the white matter, the centrum ovale, gliomata.

Prognosis.—The prognosis in brain tumor is generally unfavorable, and death within one or two years after the appearance of the first symptoms may be predicted. Spontaneous recovery is unheard of, and improvement as a consequence of treatment is very rare and has only been observed in cases of gummatous or tuberculous neoplasms. Here it occurs beyond question, consequently the prognosis is much less gloomy in these than in other tumors. In general, the course is, in spite of all treatment, steadily progressive. The patient's sufferings increase in severity, and the agony is only blunted by the dulling of the sensorium. Death occasionally sets in suddenly, as a rule only after a protracted state of marasmus in consequence of exhaustion.

Treatment.—The treatment is in the vast majority of cases of no avail. Only in rare instances can we by a systematic administration of potassium iodide (5.0 to 8.0 [grs. lxxv to 3 ij] daily in hot milk for one and a half to two months) effect a noticeable improvement. Whether this is due to the direct action of the iodide on the tumor, or whether only the secondary changes, the softening, the œdema, the accumulation of fluid in the ventricles are influenced thereby, we do not know. As a matter of fact, however, the improvement does occasionally occur, and, be it explicitly stated, not only in cases of gummata, but also in other, malignant, neoplasms. Besides iodide of potassium, arsenic seems at times to have a beneficial action, yet sufficient positive observations are wanting on this point.

The question of operative interference, if such appear indicated, involves the same principles which we have set forth in connection with operation for abscess, and which ought to guide us here also. Symptoms pointing unmistakably to an exudation into the ventricles justify trephining and tapping of the lateral ventricles for the purpose of lowering the intracranial pressure. The posterior fossa is always a sort of a *noli me tangere* (Wernicke). Headache, vertigo, and vomiting are to be treated symptomatically. Instructive cases of brain tumors, in which an operation was performed, have recently been published by Erb (Deutsche Zeitschr. für Nervenheilk., ii (1892), p. 414).

LITERATURE.

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