

simultaneously. The brain-tissue, being soft and easily broken up, is rapidly disassociated, and its elements disintegrated, and in a short time a soft, pultaceous red mass results, which more and more assumes a purulent character, becoming first reddish-yellow, then yellow or greenish-yellow, ultimately almost white. The limiting membrane consists of a connective-tissue material constructed from the neuroglia. The part which the cells of the neuroglia and the cellular elements of the gray matter (which most readily takes on the suppurative inflammation) assume in the process is not definitely known, as Rindfleisch frankly admits. The encysted abscess may take either of two directions: the pus may be gradually absorbed, the cyst undergoing calcification, or, after a quiescent period, set up a new disturbance, ending in death, which is vastly more common. When the abscess approaches the surface, meningitis is excited and adhesions of the membranes may take place to neighboring parts and to the walls of the abscess. The injury caused by an abscess is not limited to the portion of brain inflamed, but the neighboring territory is in the condition of collateral hyperæmia and œdema.

Symptoms.—There are three stages in the course of encephalitis: inflammatory; period of silence; coma. Not all conform to this, and hence variations must receive some attention, and the symptoms are much influenced by the locality of the lesions. There are symptoms common to cerebral abscess, and symptoms only produced by abscess in certain situations. The symptoms of the inflammatory stage are headache, vertigo, noises in the ears, double vision, strabismus (temporary), sometimes affections of speech, numbness and tingling in certain members, sudden muscular cramps, incoördination of muscles in walking, sometimes nausea and vomiting without cause, irritability of the bladder, etc. If these symptoms have followed a blow on the head, or have come on in the course of an otorrhœa, or of a long-standing affection of the nose, attention should be directed to the probable development of an encephalitis. After some days or weeks of these symptoms an apoplectic seizure may occur, or convulsions of an epileptiform character or delirium. Rigidity and contraction of one side or of both sides are found to exist, succeeding the seizure, the period of unconsciousness being short; also strabismus, double vision, and embarrassment of speech (amnesic aphasia). Sometimes the members contracted, sometimes on the other side, are attacked by clonic spasms, and occasionally there are general convulsions of an epileptiform type. The intellect is not always disturbed at the beginning, but there may be acute maniacal delirium or simply confusion of mind. It rarely happens that paralysis—a symptom of depression—appears as an initial symptom, and, if so, it may be safely assumed that the symptoms of irritation escaped notice. Heightened general sensibility—hyperæsthesia—is present in the parts, the seat of contractions or spasms, but anæsthesia accom-

panies the period of depression. These symptoms of the inflammatory stage are attended by fever, not of a special type, the thermometer rising to 102° or 103° Fahr. The pulse is at this period full and strong. The urine is scanty and high-colored. Nausea and vomiting are very persistent symptoms in some cases, and occur to a greater or less extent in all, and this statement is equally true of constipation. The inflammation stage proceeds to the formation of pus, and includes the incapsulation of the abscess. When the purulent elements are diffusing through and disassociating the nervous tissue, the symptoms of depression succeed to excitation. The formation of pus may take place in five or six days, certainly within ten. When this period is reached, mental excitement is succeeded by somnolence passing into stupor, contractions and rigidity yield to relaxation and paralysis, the pulse becomes slow, the respirations shallow and irregular, the coma deepens, all reflex movements are suspended, and death ensues. Excluding the prodromic period, the whole course of the disease may have been completed within seven to ten days. Death may also occur in these cases in the apoplectic coma, in the convulsions, or in the acute delirium which marks the onset of the inflammatory period. The cases do not all pursue the course just indicated. When the stage of depression is reached there may be a period of improvement, or the case may continue with the hemiplegia, the local paralysis, at a fixed point, the general condition, however, becoming much better. If the abscess is so situated in the hemispheres as not to involve the motor or sensory tracts, the symptoms of excitation will consist of delirium, epileptiform attacks, etc., and fever. The fever, as the author has witnessed, and verified the observation by *post-mortem* examination, may be intermittent, and, although somewhat irregularly so, be regarded as a genuine intermittent, and treated with quinia. The period of silence is rather a remission than a complete cessation of all morbid phenomena. As already indicated, some weakness or paralysis, lowered sensibility, defect of language, or impairment of mind remains. The abscess has been inclosed in its limiting membrane, and cut off from present mischief. In one case observed by the author, the patient so far improved in condition as to resume his occupation after a serious illness, but he still suffered from headache and vertigo and dimness of vision, and he experienced a remarkable change in his mental state: having been silent and reticent before, he became extremely talkative and communicative. This fact is all the more remarkable, since the abscess occupied the right anterior lobe. The period of silence is of variable duration, lasting from a few weeks to several months, during which the patient may be cut off by some intercurrent disease. There seems to be a relation between abscess of the right hemisphere and pneumonia. This period may be suddenly terminated by the abscess bursting into the ventricle, or at the surface of the hemisphere, which will be an-

nounced by violent convulsions, coma, and insensibility. Usually the end of this period is announced by an attack of intense headache, soon followed by drowsiness, and terminating in coma, or by convulsions and coma, or more slowly by a new meningitis. Not all cases of encephalitis pursue the defined course just described. The formation of the abscess may be quite latent, and no symptoms attract attention until convulsions and coma announce the end. Various forms are described by systematic writers, thus: the *meningeal form*, in which the fever is high, the delirium acute; the *comatose form*, in which the symptoms of excitation have been latent, and the early development of coma, dilated pupils, convulsions, and muscular resolution, indicate the extension of suppuration and early death; the *paralytic form*, in which limited abscesses occur in the motor ganglia at the base, and paralytic symptoms—hemiplegia, aphasia, and ocular disturbances—are present; the *apoplectic form*, in which sudden unconsciousness, followed by rigidity and paralysis, is the prominent feature; and the *epileptic form*, characterized by the predominance of eclampsia, succeeded by paralytic disorders.

Course, Duration, and Termination.—Notwithstanding the variability of the symptoms, encephalitis pursues a course not without uniformity. From the reception of the injury until the development of active symptoms is the prodromal period, of uncertain duration, from a few days to several weeks, even months. When the inflammatory process actually begins, the duration of the stage is about a week. Death may occur at this period. The period of silence is very variable also, and may be a few weeks' to several months' duration. A few hours or a day or two end this stage. The usual termination is in death. Recovery has taken place during the stage of inflammation, and by the discharge of pus spontaneously or by puncture.

Diagnosis.—The diagnosis involves the question of the seat of the abscess and the differentiation of abscess from tumor, from cerebral hemorrhage, and from meningitis. If the abscess is situated in the hæmispheres above the motor ganglia, there will be delirium and convulsions, and not contractions or paralysis; and, if in the region supplied by the left middle cerebral artery, amnesic aphasia will be present. If the abscess forms in the motor ganglia at the base, hemiplegia will be the prominent symptom; or paraplegia, should there be an abscess on both sides. If the abscess forms in the middle fossa of the skull, about the sella turcica, and involves the crus cerebri, there will be paralysis of the extremities on the opposite side, and of the third nerve on the same side. If the abscess occurs in the neighborhood of the pons, so as to impinge on one side, there will be a crossed paralysis of the facial on the same side and of the members on the opposite side. Abscess of the cerebellum gives rise to incoördination of muscular movements, vertigo, vomiting, amaurosis, and convulsions. In abscesses of

the base, the cavernous sinus is compressed, and hence there will be present swelling of the eyelids, injection of the conjunctiva, and epistaxis. On ophthalmoscopic examination, the retinal veins are swollen, tortuous, and the disks are congested and stuffed (choked disks), but, in the further progress of the cases, white atrophy ultimately results. In abscess of the base and cerebellum, the retinal congestion occurs earlier and is more pronounced. There is no symptom of tumor which may not occur in abscess, but still a distinction may often be made. Tumor develops more slowly than abscess, and is unaccompanied by fever. The symptoms are continuous in cases of tumor, and there is no period of silence. Abscess is often connected with injury, with caries of the bones, disease of the ear and nose; tumor develops without any cause. Between the apoplectic form of abscess and cerebral hæmorrhage there is no well-marked distinction except as to termination, which resolves the doubts. The other forms of abscess do not come into relation to cerebral hæmorrhage. Abscess of the cortex and meningitis present the same symptoms of irritation followed by depression, but in the latter there is no period of silence followed by relapse.

Treatment.—The stage of inflammation requires active measures to prevent further mischief, as the remedies already advised for acute meningitis. Ergot, quinine, and chloride of barium (liq. barii chloridi \mathfrak{m} xx every four hours) are the most efficient means of preventing the migration of the white corpuscles and the diapedesis of the red. When suppuration occurs, it is good practice to check the formation of pus, and the collateral œdema and hyperæmia, by full doses of quinine. The propriety of trephining, or of puncturing the brain, to favor the exit of pus, is a question of purely surgical interest, into the discussion of which we do not purpose to enter.

INTRA-CRANIAL TUMORS.

Definition.—The term *intra-cranial tumor* is a more correct designation than cerebral tumor, for it includes all neoplasms so situated as to affect the contents of the cranium. The term cerebral tumor takes into consideration, if restricted to its proper meaning only, tumors of the cerebrum, and not those of the meninges, of the vessels, etc. By the term *tumor* in this connection are intended all kinds of growths or outgrowths, and it is not confined to its merely technical signification.

Causes.—Intra-cranial tumors are usually divided into four groups: the vascular; the parasitic; the diathetic; and the accidental. Tumors are more common in men than in women, simply because men are more exposed to the influences producing them. Injuries excite osseous and connective-tissue hyperplasia, and a violent strain may be the cause of an aneurism. The diathetic tumors are in part transmitted by inheritance, in part acquired.

Pathological Anatomy.—Of 551 cases of *aneurism* in various parts of the body, only seven were intra-cranial.* The arteries of the base only are concerned, for a miliary aneurism is not a tumor in the sense in which that term is here used. The internal carotid and its branches are most frequently affected; in a total of 172 cases, 116 were of these vessels, and 53 were of the vertebro-basilar arteries. Taking individual arteries, we find that in a collection of 142 cases there were forty-one of aneurism of the middle cerebral, forty of the basilar, twenty-three of the internal carotid, fourteen of the anterior cerebral, eight of the posterior communicating, seven of the vertebral, four of the posterior cerebral, three of the inferior cerebellar, and two of the anterior communicating. As respects the side of the brain, the left is more frequently affected by aneurism. In a collection of sixty cases, thirty-five were on the left and twenty-five on the right side.† As regards size, intra-cranial aneurisms vary greatly, those of the anterior and middle cerebral artery attaining to the greatest size. From a pea to a pigeon's-egg is the usual size, but they may attain to the dimensions of a hen's-egg. The *parasitic tumors* consist of the *cysticercus cellulosæ*, or the *echinococcus*. The former are small vesicles the size of a pigeon's-egg, composed of a transparent wall and pellucid contents. They are found often in large numbers in the gray matter of the hemispheres, in the pia mater, and, as the author has seen, on the floor of the fourth ventricle. The *echinococcus* cyst is larger, often solitary, and never exceeding three to five. It has a tougher investing membrane, but transparent contents in which can be seen the scolex with its hooklets (Davaine). The *diathetic tumors* are cancer, syphilis, and tubercle. Cancer is a very frequent form of tumor, and, although at one time was supposed never to occur as a primary disease, is now known to be often primary. According to the statistics of Lebert, of forty-eight cases of cerebral cancer, thirty-five were primary. According to Bacon,‡ only ten in seventy-three cases were primary. Ogle§ finds that thirteen out of twenty-five occurred in the brain alone. When secondary, there are several nodules; when primary, a single one, which is usually quite separated from the tissue in which it is imbedded. The largest tumors are those growing in the hemispheres, an example of which the author saw, having the dimensions of the closed fist. The form is usually encephaloid, rarely scirrhus, still more rarely colloid and melanoid. The position of the cancer, named in

* "Transactions of the Pathological Society," vol. vii, *op. cit.*

† The above statistics of intra-cranial aneurism were obtained from an article on "Aneurism of the Brain" by the author, published in the "American Journal of the Medical Sciences," October, 1872. The statistics of Lebert, of Durand, and of Gougenheim, were analyzed in this article.

‡ "On Primary Cancer of the Brain," London, 1865, pamphlet.

§ Reynolds's "System of Medicine," vol. ii.

the order of relative frequency, is the hemispheres, the cerebellum, corpus striatum, optic thalamus, and pons. Cancer of the orbit, of the scalp, or of the cranial bones, may grow inwardly to the brain; on the other hand, cancer of the brain tends to develop outwardly. The form of *syphilitic tumor* is a gumma of the dura, and may occur at the convexity, but its favorite site is in the middle fossa of the skull, about the sella turcica. They do not attain to great dimensions, rarely exceeding a walnut, and more frequently having the size, as also the shape, of an almond. *Tubercle-masses* consist of an aggregation of cheesy nodules, and vary in size from a pea to a walnut. The most frequent situations are the cerebellum and the hemispheres, and much less often the corpus striatum and optic thalamus. The group of intra-cranial tumors called *accidental* contains glioma, sarcoma, steatoma, myxoma, psammomata and exostoses. Gliomata develop from the neuroglia, and are hard or soft, according to the quantity of granular and cellular contents and fibrillæ. They are very vascular, and hence may be accompanied by considerable hæmorrhage. They are found in the hemispheres, in the gray and white matter, and may be attached to the membranes. Of the sarcomata, there are several varieties; they may adhere to the meninges, or develop in the hemispheres, or in the motor ganglia, at the base. Lastly, the cholesteatoma, which grows from the arachnoid or pia mater, and is found on the hemispheres and in the posterior fossa, attains by the aggregation of several smaller tumors sometimes to the size of a goose-egg. A growing tumor affects the parts in its immediate neighborhood by the irritation which its presence excites, and by destruction of tissue effected by pressure. Neuritis and ultimate softening and disintegration of nerves impinged on, inflammation, absorption, and softening of the adjacent portion of cerebral matter, are pathological results of the proximity of a tumor to the intra-cranial organs. Besides the local effect, a growing tumor increases the pressure of the organs, and causes a displacement of the movable contents of the cavity, the blood and cerebro-spinal fluid, and an approximation of the perivascular lymph-spaces. Pressure on the sinuses interferes with the venous circulation.

Symptoms.—The symptoms produced by intra-cranial tumors are divisible into two classes: those common to tumors in all situations; those caused only by tumors in particular situations. In the first group are headache, vertigo, amaurosis, convulsions, and mental disorders; in the second, aphasia, strabismus, ocular paralyse, and hemiplegia, tic-douloureux, facial spasm or paralysis, deafness, incoördination, vomiting, crossed paralyse, etc. Headache is of so persistent and violent character that Ladame* holds it has high diagnostic importance. It consists of paroxysms of acute pain and a constant feeling of uneasiness. The pain is increased by jarring the head, by

* "Symptomatologie und Diagnostik der Hirngeschwülste," Würzburg, 1865.

tapping even gently, and by a full inspiration. Sometimes the position of the pain indicates the site of the neoplasm; as pain in the forehead, when the tumor is in the anterior lobe; in the occiput, when the tumor is in the cerebellum. Vertigo comes on usually some time after the headache, and is present to a greater or less extent in all cases, but is more pronounced in the case of tumor of the cerebellum. Slight fainting-fits, with or without the most transient loss of consciousness, and accompanied by intense vertiginous sensations, occur in many cases. Early in the development of the tumor the vertigo subsides on assuming the recumbent posture and closing the eyes, but later the vertigo comes on severely when the position is horizontal, the bed and all objects being in more or less rapid motion. In advanced cases, the vertigo is so severe as to prevent walking, or at least to render it difficult and uncertain. Amblyopia and amaurosis are also symptoms of tumor in any situation, for, as Hughlings Jackson well says, "so far as the production of optic neuritis by intra-cranial disease is concerned, the position of the disease seems to be of little consequence, and there is nothing very peculiar in its nature, except that it is usually coarse." Graefe held that the retinal changes were due to direct pressure on the cavernous sinus, the return of blood from the orbit being thus prevented, but Lancereaux and others demonstrated that the pressure was not sufficient to do this in the case of many tumors situated at a distance. Neuro-retinitis, then, is a general symptom of intra-cranial tumor, but the retinal and orbital changes may also have special significance. Convulsions, local and partial, may furnish topographical indications, but general convulsion may accompany tumor in any situation, unless we except the pons Varolii, on the dictum of Ladame. Greater or less departure from a healthy mental state is observed in all cases of tumor, and those involving the gray matter probably affect the mind more, but actual insanity has been observed in about one third only. In many cases, changes of disposition occur, usually in the way of moroseness, irritability, and depression; in others, the faculties seem enfeebled, the power to apply the mind to any intellectual effort wanting: but the author has seen a case in which the patient, a clerk, developed a great capacity for the acquisition of languages during the time when the tumor, which occupied the posterior lobe of the left hemisphere, was forming. Eccentricities of conduct, delusions, and various other forms of mental derangement, accompany tumors of the brain, and a considerable proportion of such cases enter asylums for the insane. The symptoms which serve to indicate the position of the neoplasm are very important, and often extremely characteristic. The existence of amnesic aphasia—loss of the memory for words—strongly implies lesion of the left anterior lobe, fissure of Sylvius or island of Reil, or of the parts supplied by the left middle cerebral. A tumor of the cor-

tex of either hemisphere may give rise to convulsive movements in the hand and arm of the opposite side, with or without general convulsions and loss of consciousness, and, if posterior, will involve sensibility as well as motility. A tumor impinging on the motor centers (*corpus striatum*, *thalamus opticus*, etc.) will produce first, irritation—spasmodic contraction and rigidity on the opposite side, and next depression by destruction of tissue—paralysis on the opposite side of the body. A tumor so situated as to impinge on the *crus cerebri* and the third nerve will produce symptoms differing according to the injury done; if the result is irritation, irregular movements of the eye (*nystagmus*) on the same side, and rigidity and contraction in the muscles of the opposite side of the body; if the result is destruction of tissue, there will be ptosis, convergent strabismus, and dilated pupil in the eye of the same side, and paralysis of the muscles on the opposite side of the body. If a tumor is so situated as to compress the optic nerve at the outer side of the chiasm, the field of vision will be narrowed to a degree corresponding to the extent of the injury, and destruction of the chiasm would cause blindness. Irritation of the olfactory would give rise to strange smells, and destruction of the nerve to loss of the function. Tumors at the base may involve several cranial nerves, causing disturbances of great significance, either of irritation or loss of function. If the fifth nerve is irritated, *tic-douloureux* will be the result; but, if the nerve is destroyed, there will be anæsthesia of all the parts to which the nerve is distributed. A tumor of the pons can be diagnosed by the implication of the fourth, fifth, and sixth nerves on the same side, and by disorders of motility and sensibility on the opposite side, and by the absence of convulsions (Ladame). A tumor of the *medulla oblongata* causes disturbances in the important functions whose centers are located here—in speech, deglutition, respiration—causes disorders of sensibility and motility on the opposite side and of the face on the same side; causes vomiting, constipation, and paralysis of the bladder, etc. Tumors of the *corpora quadrigemina* affect the motions of the eyes, set up double optic neuritis, and cause paralysis on the opposite side of the body. Tumors of the cerebellum disorder the function of coördination, especially of those movements requiring the eyes to guide them, cause excessive vertigo, and difficulty in maintaining the upright position, optic neuritis and early extinction of vision, and general convulsions. Tumors at the base, by pressure on the cavernous sinus, interfere with the return of blood from the facial vein, and cause swelling of the eyelids, bleeding at the nose, and fullness about the orbit. A growing tumor, by displacing the cerebro-spinal fluid through the internal and external sheath of the optic nerve, renders the eye more prominent, and, by pressure on the cavernous sinus, maintains congestion of the orbital and retinal veins; and hence, although retinitis occurs when

tumors are in the hemisphere anywhere, it will develop earlier and more severely in the case of tumor at the base. It has been ascertained that considerable atrophy of the optic disks is not incompatible with fairly good vision. The general condition of the subjects of intra-cranial tumor may be very good. When there is vomiting, there will be wasting from an inability to retain the necessary aliment. If the tumor is cancer, the peculiar earthy hue, the wasting, and emaciation will soon be manifest.

Course, Duration, and Termination.—Obviously, there can be no uniformity in the course of tumor. The symptoms are, at first, very indefinite, and, in the case of some of them, at least months are occupied in developing any well-defined ailment. A persistent headache, vertigo, alterations of demeanor, are first noticed, and gradually the character of the case becomes known. Tumors situated in parts of the brain that are well called "indifferent" may never cause characteristic symptoms, but usually now a correct diagnosis may be made if the case is thoroughly evolved. The duration of tumor varies from two to three months, up to five or more years. Unless the tumor is syphilitic, or possibly aneurismal, there can be but one termination. Some end in a convulsion, or rather in the secondary coma which follows it; others are cut off by an intercurrent disease, and notably pneumonia, or by cerebral hæmorrhage, or by acute meningitis. Aneurism terminates by rupture, unless by treatment its consolidation may be effected. Before the access of the final coma a remarkable degree of somnolence is observed in some cases, sleep continuing for several days at a time uninterruptedly.

Diagnosis.—The determination of the position of the tumor has been sufficiently considered. Can a diagnosis be made of its nature? Aneurism occurs in adults or the old; in those who continue to have good health, and who are not affected by a diathesis or an hereditary ailment. Vomiting is not usual; the cranial nerves are early paralyzed, and on the same side as the tumor; the mental functions are not often affected; epileptiform seizures do not occur, and the termination is by an apoplectic attack. An aneurism of the internal carotid within the carotid canal will cause protrusion of the eye by obstruction of the cavernous sinus, and may be accompanied by an audible *bruit*. A tubercular tumor is usually accompanied by the evidences of tubercular deposit elsewhere. The subject is young, and evidences of hereditary taint may be present; it is situated deeply, often in the indifferent districts, and does not produce disturbances in the cranial nerves. Syphilitic gummata have a tendency to form in the middle fossa, and to affect the *crus cerebri* and third nerve, and are usually coincident with external lesions. Echinococci or cysticerci are accompanied by numerous epileptic attacks, at first without any injury, but subsequently the mind becomes torpid, and passes

into dementia. Local paralysis and hemiplegia are uncommon. The distinctions between tumor and abscess have been given in the article on abscess. The differentiation between obstruction of the cerebral vessels and tumor may often be a matter of extreme difficulty. Tumor may appear at any age; thrombosis is usually a disease of advanced life. Thrombosis is accompanied by and due to chronic arteritis; tumor is not related to general arterial changes. Tumor is characterized by intense headache; thrombosis by less severe and persistent. Tumor is generally accompanied by epileptiform attacks; thrombosis by apoplectic. Tumor affects the cranial nerves, and causes localized paralysis; thrombosis never produces such results.

Treatment.—There are two remedies which ought always to be used—iodide of potassium and ergot; for, although only syphilitic and possibly aneurismal tumors are remediable, the case under treatment may be one of them. Scruple-doses of the iodide of potassium should be given until iodism is induced. If no improvement is then manifest, it need not be continued. A drachm or two of the fluid extract of ergot four times a day may properly be given for several weeks succeeding the iodide. The repetition of these remedies will depend on the results of their first administration. They may effect a cure of the syphilitic and vascular neoplasms.

APHASIA.

Definition.—Inability to use spoken language or to give vocal utterance to ideas is designated *aphasia*. The defect may consist in a loss of memory of the words by which ideas are expressed, when it is called *amnesic aphasia*; it may consist, not in forgetfulness of the words, but in an inability to combine the different parts of the vocal apparatus for vocal expression—*ataxic aphasia*. When the defect involves written language, and consists in an inability to recognize and make the signs by which ideas are communicated in written language, it is named *agraphia*, and this may be either *amnesic* or *ataxic*—the former being a mental defect, the latter an affection of the muscular apparatus, known as writer's cramp. Amnesic aphasia exists to a variable extent, and may, indeed, involve but a limited number of words. *Paraphasia* is a term proposed by Kussmaul* to signify the mental state in which the wrong words are used, or unintelligible expressions employed to express the idea. There may also be a *paragraphia*—a state in which wrong or meaningless written signs may be used to express the idea.

Pathogeny.—Aphasia and its various modifications are associated with a number of intra-cranial lesions; with occlusion, either by thrombosis or embolism of the vessels; with cerebral hæmorrhage; with

* Ziemssen's "Cyclopædia," *op. cit.*