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APPENDIX.—PARASITES OF THE BRAIN.

Among the parasites found in the brain the cysticerci and the echinococci are the most important.

The former—the cysticerci—are found quite frequently at the autopsy when their existence during life was not diagnosticated or even suspected—a proof that they may be present without giving rise to any symptoms, or that they may produce a clinical picture such as is often due to other causes. The cysts, which are rarely single, but mostly multiple, amounting as they may to one hundred or more in number, have their seat, some in the meninges, some in the substance of the brain, in the gray as well as in the white matter; sometimes they are free in the ventricles. They may be so numerous that the whole surface of the brain is studded with them. Their size may vary from that of a bean to that of a walnut, and but rarely exceeds that of the latter. They contain a serous fluid. At a place where the cyst wall is somewhat thickened are situated the neck and head, the latter often deeply pigmented, and to be recognized on closer examination by a crown of hooklets and suckers. The parts surrounding the cyst are either perfectly normal or in a state of inflammatory softening. This latter is found as a rule only when the cysticercus is dead and has undergone changes. If the cyst sends out diverticula it assumes the form of a bunch of grapes, and hence is called cysticercus racemosus (Virchow, Marchand). It is estimated that the parasites live from three to six years. After their death they are changed into calcareous concretions, surrounded by a connective-tissue membrane, which in their interior contain cholesterine and fat.

Fig. 88.—Cysticercus Racemosus. (After Marchand.)

It is impossible to sketch a clinical picture produced by cysticerci in the brain, because this varies, of course, with the seat of the cysts. I had occasion in the past few years to observe four cases in my clinic, and of these only one was diag-

nosticated during life, and this one not because it presented characteristic symptoms, but owing to the history of the patient, from which we learned that he was in the habit of frequently eating raw pork. In all four cases the patients suffered from epileptiform attacks with convulsions, sometimes with, sometimes without, loss of consciousness. Two of them were in the intervals between the attacks temporarily completely bewildered, and were sometimes for hours not able to find their way in the ward where they were staying, did not recognize their fellow-patients—in short, presented conditions which, considering the attacks which they were subject to, were looked upon as epileptic equivalents. Motor disturbances were not observed in any of the cases; all of them, however, complained at times of headache and vertigo. In one case three cysts the size of a pea were found imbedded in the left lenticular and caudate nucleus, the internal capsule being spared, so that the patient had had perfect use of the right extremities. In another case there was found a focus of softening the size of a pea, in which the calcified remains of a cysticercus could be demonstrated, in the left half of the middle segment of the pons immediately below the middle line, without there having been during life any noticeable symptoms of destruction. A third case showed, besides numerous vesicles imbedded in the gray cortex, cysticerci swimming free in the fluid of the ventricles, the amount of which was considerably increased. The high grade of hydrocephalus was probably responsible for the mental enfeeblement of the patient, a condition for which during life the epileptic attacks had been held accountable; these, in their turn, were doubtless connected with the parasites in the cortex. Cases presenting a course which resembles that of the progressive paralysis of the insane I have myself not had occasion to observe. According to Wernicke, such instances are not rare (*loc. cit.*, III, 373). Michael has described a case in which the presence of a free cysticercus in the fourth ventricle gave rise for a considerable period of time to a picture simulating diabetes mellitus (Deutsch. Arch. für klin. Med., 1889, xliv, 5, 6).

Hence it is evident that a diagnosis of cysticerci and echinococci in the brain can only be made if we know that the patient has had a tapeworm, or if we have been able to demonstrate cysticerci in the muscles, the eyes, etc. If in such cases epileptiform attacks set in, which alternate with conditions of

paresis, and if we are able to exclude syphilis and tuberculosis, we are justified in suspecting the presence of parasites, especially of cysticerci.

The ætiology of cysticerci in the brain is that of cysticerci in any other part of the body; they will develop in persons who often give the parasites a chance to invade their body, as is, for instance, the case with butchers, and hence they occur relatively frequently in such individuals. Therapeutics in this case is powerless; we have no means of destroying the parasite.

Echinococci are usually found in single solitary vesicles on the free surface of the brain or the ventricles. Their yellowish mucoid contents, surrounded by a cyst-wall and a connective-tissue capsule, can break through to the outside, and be evacuated through the nose, the ears, etc., and a sort of spontaneous recovery take place.

Echinococci of the brain often do not present any peculiar symptoms which could be used for diagnosis. The clinical picture by which they manifest themselves is usually that of a tumor, but when they have perforated to the outside we may be able to demonstrate on the protruding tumor fluctuation and pulsation. If they perforate into the orbit they give rise to œdema of the lids and exophthalmus. Westphal has observed a case in which over ninety cysts were evacuated to the outside.

That actinomycosis may occur in the human brain is shown by the publication of Bollinger (cf. lit.), where a tumor in the third ventricle is described which contained numerous characteristic granules. Often the diagnosis remains obscure, as happens sometimes also in actinomycotic affections of the lungs; the process in the brain may remain latent (Orlow, cf. lit.).

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CONGENITAL DISEASES—HYDROCEPHALUS—MENINGOCELE—PORENCEPHALY—ABSENCE OF CERTAIN PARTS OF THE BRAIN.

Our knowledge of the collections of fluid in the brain, which are described under the general term of hydrocephalus, is, on the whole, very defective, and this is even more true of the causes which bring about the abnormal increase. We know that the fluid is either contained between the meninges or within the ventricles, and speak accordingly of a hydrocephalus externus and internus. We know further that it may collect very rapidly or very slowly. In the former case we have a hydrocephalus acutus, and in the latter a hydrocephalus chronicus. Finally, we know that the conditions under which it develops may sometimes exist during intra-uterine life, or, again, may appear much later, and we consequently distinguish the congenital from the acquired form. But, after all, the distinction which we gain by this is only superficial. About the exact manner of development of any of these forms there prevails a great difference of opinion, and the question under what circumstances hydrocephalus may develop as an independent idiopathic disease can not be satisfactorily answered. There is no doubt but that in by far the greater majority of cases we have to do with a congenital disease, and, as a matter of fact, this form plays in practice the most important *rôle*.

The congenital hydrocephalus is very rarely external, but is much more often internal. It may be well developed at birth, so that the circumference of the skull measures sixty or seventy centimetres or more. The skull bones then are usually so thin that their thickness scarcely amounts to that of a sheet of paper. The fontanelles and sutures are separated by wide gaps. The distention of the ventricles may be so enormous

that they form a large cavity which is surrounded by brain substance one and a half to two centimetres thick. The lateral ventricles are usually dilated to a much greater extent than the third and fourth; still, these latter may also be moderately distended. The whole brain, more particularly the basal structures, presents the signs of an increased intracranial pressure; they are flattened out, the corpus callosum may suffer considerably from pressure (Schroeter, Allgem. Zeitschrift f. Psychiatrie, 1888, xliv, 4, 5), the commissures are stretched,

Fig. 89.—HYDROCEPHALUS (personal observation).

the foramen of Monroe is very large, the walls of the ventricles are often covered with granulations, the ependyma inflamed and in places slightly thickened. The colorless serous fluid, the amount of which may be as much as one and a half litres, contains 99 per cent. of water, 0.3 per cent. albumin, traces of salts, and so forth, and the sp. gr. is 1.004 to 1.006 (cf. Anton, Zur Anatomie des Hydrocephalus u. s. w., Med. Jahrb. 84, Jahrg. 1888, N. F. iii, Heft 4, p. 125, from Meynert's clinic).

The most conspicuous symptom of hydrocephalus is the peculiar enlargement of the head. This is, however, not always apparent in the first weeks. Sometimes one and a half or two months may pass before the increase in size begins to be noticeable. The circumference of the head, which at birth measures forty centimetres, and a year later forty-four centimetres, rapidly becomes greater, and every week a half or one centimetre is added to it, so that after a certain time, often only after a few months, the head has reached in circumference a size which it does not generally attain to before the age of puberty—viz., fifty centimetres. If the distention of the skull is equal on all sides it becomes spherical, and forms a striking contrast to the smallness of the face, which, of course, does not take part in the enlargement. If, however, this is more marked in the sagittal diameter, the skull assumes a dolichocephalic form, and its appearance is no less bizarre. This is still more accentuated by the enormously enlarged veins which as blue cords run over the skull. The eyes are frequently directed downward. This may depend upon an insufficient innervation of the eye muscles. The appearance of a child with a well-developed hydrocephalus, the enormous head, which, if the child is held erect, rolls from side to side, the small trunk which with its shrunken limbs looks as if it was only an appendage of the head, the idiotic facial expression, are together characteristic enough to warrant the diagnosis without any further examination, which would reveal various motor disturbances, spasms of the muscles, and sometimes increased reflexes. It need hardly be stated that the intelligence develops only in a very imperfect manner or practically not at all. Most of the children never learn to speak or at least only imperfectly. They are not able to play like others, their conduct is silly and senseless, their habits are dirty, and they require much painstaking care and nursing. In exceptional cases their mental development reaches a somewhat higher stage and they are able to comprehend certain things, so that under particularly favorable circumstances, as in a well-conducted home for feeble-minded children, it may be possible to give such children an amount of knowledge and skill which is quite remarkable. The appearance of epileptiform attacks, which are always to be anticipated, often greatly interferes with such attempts.

The course is either chronic or acute. The issue is always unfavorable. The children either die during or soon after

birth, or they attain an age of a few months, or finally they may live four or five years, while it is very exceptional for them to live longer and to reach the age of puberty. If, however, this happens, the head ceases to grow and remains of the same size or becomes even a little smaller, and the skull ossifies. If death occurs in an earlier stage, this happens either during a convulsion or comes on gradually as a consequence of general marasmus. There is no question but that in face of this affection therapeutics is powerless. We may well omit the usual inunctions of the skull with mercurial ointment or the painting with tincture of iodine, as well as the internal administration of iodide of potassium, without any feeling of self-reproach, for, often as these measures have been used, rarely has any good result from them been seen. Good general nursing of the child, later a well-conducted simple instruction as far as this is feasible, finally, symptomatic treatment, more especially of the more dominating symptoms, as the epileptiform seizures, which are best met with bromides, is more rational than any other more or less futile measures, not excluding puncture of the head and other surgical interference. That we are ignorant of the ætiology we have said above, and would only add here that the statement that syphilis and alcoholism in the parents are predisposing causes, is without foundation.

The idiopathic hydrocephalus which appears later in life may be connected with atheromatous processes and focal diseases in the brain. Owing to the rarity of its occurrence, however, it has been but little studied, and the possibility that even in such cases we have in reality to deal with the secondary, deuteropathic, hydrocephalus is by no means excluded.

The secondary hydrocephalus has at times to be attributed to disturbances of the circulation, at times to general disorders of nutrition. Among the former may be mentioned active hyperæmias of the brain, occurring in consequence of the abuse of alcohol, and venous stasis, as it is seen in valvular diseases of the heart and emphysema. There are, besides, the circulatory disturbances caused by circumscribed meningitides, tumors, and abscesses, by which, for example, obstruction of the aqueduct of Sylvius may be brought about (Seeligmüller). Among the disturbances in nutrition there are certain forms of anæmia, general dropsy, phthisis pulmonalis (Callender). The affection may run a very acute course and prove fatal in a few days. On the other hand, it may be eminently chronic, and

then the symptoms need not by any means be characteristic, and it may be the more difficult to make a diagnosis, as the increase in the size of the head is wont not to take place. Sometimes the symptoms are those of brain tumor; again, those of a spastic spinal paralysis may predominate.

The so-called hydrocephalus ex vacuo, a form which develops in old people under the influence of a general atrophy of the brain, must also be looked upon as a secondary hydrocephalus. It is associated with more or less pronounced dementia. About ætiology and treatment nothing need be added to what has been said on congenital hydrocephalus.

Under certain circumstances there are found defects in the bony skull cap which allow the contents to protrude. By this the dura and galea as well as the skin are raised hemispherically, constituting what is called a brain hernia or cephalocele, and we speak of an encephalocele if the brain substance and the pia are both contained in the dural sac, while if only the dropsical soft meninges are to be found in it, it is called a meningocele. Whether a local decrease of resistance of the membranous skull and defects of ossification, or perhaps abnormal adhesions of the meninges with the amnion, are the cause of such anomalies has as yet to be decided. Clinically they possess no significance.

The above-mentioned defects (page 267), which we call porencephaly (Heschl), may also be congenital. Some gyri may be entirely or partly absent, so that clefts or funnel-shaped openings or pits are formed. The defective areas, unless there be a communication with the ventricles, are covered with pial tissue, and the empty space is filled up with fluid which collects in the subarachnoidal tissue; or, again, the neighboring convolutions are pressed together over the gap, and instead of a hollow we only find a deep cleft (cf. Ziegler, Pathol. Anat., ii, 636).

Very remarkable is the fact that certain parts of the brain may be entirely absent. This has been observed for the corpus callosum, the fornix, the corpora albicantia, the gray commissure, and others. With reference to the absence of the corpus callosum various hypotheses have been put forward. It has been thought to be connected with the development of the base of the skull and to depend upon the angle which the petrous portions of the two temporal bones form with each

other (Richter, Virchow's Archiv, 106, 1886). Kaufmann has described a case where the corpus callosum was completely absent and where its formation had never even begun, so that the commencement of the disturbance in development had to be referred to a time between the third and fourth months. In this case the high grade of internal hydrocephalus which was present had to be looked upon as the cause (Arch. f. Psych. und Nervenkrank., 1887, xix, Bd. iii, page 769). This, in all probability, is more frequently than is generally supposed the immediate cause of congenital malformations due to arrest of development which is principally the result of traumatism during birth, protracted labor, asphyxia in consequence of compression, etc. Deficiency in the region of both fissures of Rolando are especially of interest because they may simulate in their clinical manifestations spastic spinal paralysis, although the resemblance is somewhat obscured by the simultaneous presence of cerebral symptoms; and there is, of course, every possible gradation, from the pure picture of a spastic spinal paralysis in which only the lower extremities are affected, to that in which the arms are implicated and cerebral symptoms are well marked. Schultze (Deutsche medicinische Wochenschrift, 15, 1889) has observed the spastic rigidity in the lower extremities in more than one member of the same family (cf. Fig. 80).

Sometimes certain parts of the brain are only imperfectly developed. Such a condition has been found in certain gyri, the optic thalami, the corpora quadrigemina, the corpora striata, and others. Schröter, among other writers, has described such a defect in the corpus callosum, which in his case was abnormally short (Allgem. Zeitschr. f. Psych., 1888, xliv, 4, 5). The cerebellum may also remain very much behind in development, so that under certain circumstances it scarcely attains the size of a walnut. The causes of such local malformations are usually as obscure as their clinical manifestations during life.