

extremities. There may, however, be only a *deficiency of the brain*, which may exist either in the longitudinal or transverse diameter. Thus hemicephalia may exist of various grades; almost the entire brain may be wanting, from the small remnants of which the cranial nerves originate. The hemispheres may be wanting, with the exception of a small portion at the base. Conjointly with this, the cranial bones are defective, or of a rudimentary formation, and the meninges primarily distended into a bladder containing water, but which, having burst very early, hangs in atrophic folds over the shapeless cerebral masses. Again, only a small portion of the brain may be wanting—the anterior lobes, for example, and olfactory bulbs, the optic thalami and optic nerves, pons Varolii, etc. Along with this, a corresponding malformation of that part of the face destined for the reception of these absent structures exists. The cranial bones in these cases, though small, may yet exist. The most striking of all defects in the longitudinal diameter is the single *cerebrum*, combined with cyclopia, and absence or deformity of the face. Next is a coalescence of the optici thalami and corpora striata; or still again, an absence of the commissures, thus splitting the brain by this condition of the parts. In these cases the formation of the bony case may have taken place normally; but idiocy and bodily defects always exist. Again, the brain, though existing, may be very *small*, but in all other respects perfectly formed; *microcephalia*. This condition occurs independently of that in which partial absence of some part exists. The vertex in these cases is low, the forehead flat, and the entire head pointed. Children so affected are capable of life and development, and, singularly enough, are not tardy in their mental development.

Excessive growth of the brain is extremely rare, and the numerous splittings of the lobes which here and there occur are to be looked upon rather as anomalies of form than excessive formations.

B.—DISEASES OF THE SPINAL CORD AND MEMBRANES.

(1.) SPINAL MENINGITIS AND MYELITIS.—The diseases of the spinal marrow are still in a state of obscurity, and all that is positively known of them could be stated in a few lines, if we were only to confine ourselves to the distinctly demonstrative anatomico-pathological alterations. First of all, as regards the much-abused hyperæmia; all *post-mortem* appearances must be excluded as spurious where the cadaver was not placed upon its face immediately after death, and the autopsy was performed later than twenty-four hours after life terminated. Without this precaution there will be found in every case, even in the

most normal, extensive *post-mortem* hypostasis, imbibition of the coloring matter of the blood, and putrid softening, by which it becomes totally impossible to establish the previous existence of any actual disease in the medulla spinalis. Although the anatomico-pathological condition is different in kind, still inflammation of the spinal cord and its membranes may be comprised in one group of symptoms, for the phenomena in both processes are almost identical, and hence a differential diagnosis becomes extremely problematical.

Pathological Anatomy.—The sac that is formed by the dura mater does not completely fill out the canal of the spinal column, but is secured there by adipose tissue, which accumulates more toward the vertebral laminae, anteriorly against the vertebral bodies by loose cellular tissue, and all around by venous plexuses. This sac of the dura mater, on its inner side, is firmly united with the external lamella of the arachnoid; while the internal lamella of the latter hangs loosely, together with the pia mater. Between these external and internal plates or lamellæ, is contained the cerebro-spinal fluid, which mingles with that of the meninges and ventricles of the brain, and even in small children may amount to a drachm. The pia mater of the cord is richer in vessels than that of the brain, and in the new-born child can readily be pulled off. Having thus briefly recapitulated the normal condition of the spinal meninges, we may proceed to the investigation of the character of the hyperæmia and of the hæmorrhage. In young children the cerebral arachnoid and pia mater, and the veins within the spinal canal, are always plethoric; in fact, the vessels are so full that, even when the precaution is taken of turning the body on its face immediately after death, extravasations are not of unfrequent occurrence. These pathological phenomena were first explained by *Weber*, of Kiel. It is not always easy to determine whether the blood found *external* to the dura mater was extravasated during life, or whether the blood was poured out upon the dura mater, from veins that have been severed during the removal of the vertebral laminae. The best means of guarding against an error is not to attempt the removal of very long sections of the vertebral laminae at one time, but to remove small portions, at different places, and then allow a feeble stream of water to play upon the exposed dura mater. The blood exuded from the veins after death is entirely washed away in this manner, while that extravasated during life is always somewhat coagulated, and adheres rather firmly to the dura mater. These hæmorrhages are most frequently found in the cervical and lumbar regions, sometimes extending but a short distance, or lining the whole spinal canal, forming a complete sheath of coagulated blood. Small extravasations are sometimes seen more distinctly upon the disarticulated vertebral laminae

than upon the dura mater, and for that reason the inner surface of the former must always be thoroughly examined. The same kind of hæmorrhages which occur externally to the dura mater are also met with in the sac between the dura mater and arachnoid, or the latter and pia mater. Here also the amount of the extravasations varies between a pin's head and such a quantity that the whole cord is surrounded by blood. It is less easy here for one to fall into an error, in supposing that this fluid has originated during the autopsy, because the dura mater has no large veins which might have been severed. Aside from these hæmorrhages which, conjointly with the consideration of inflammation, have been disposed of, as the highest grade of hyperæmia, true exudations also occur upon and beneath the meninges. In the loose cellular tissue between the dura mater and the bony spinal canal some serum is always found, even in the normal condition; it may, however, become considerably augmented, and, like a gelatinous mass, cover large regions of dura mater as well as remain adherent to the inner surface of the disarticulated laminae. In older children, after injuries to the spine, or in spondylitis, a visible opacity and thickening of this membrane are also found, along with a deposit of a plastic fibrinous character. In all children a moderate quantity of spinal fluid is found on opening into the dura mater, which normally is of a pale-yellow color and perfectly clear, but which, in affections of the arachnoid and pia mater, becomes opaque, flocculent, and bloody. Bloody discolored spinal fluid is especially found in children dying from pyæmia during the prevalence of an epidemic of puerperal fever. The fluid exudations are always found in the most dependent part, according to the position of the body. In rare instances, a fibrinous deposit is found upon the dura mater conjointly with the flocculent cerebro-spinal fluid, which, like the purulent meningitis within the cranium, may become of a purulent nature. Usually the spinal cord itself, in these morbid alterations of its membranes, is softened and eroded, so that it is difficult, in examining the spinal cord of a child, to diagnosticate a softening or sclerosis merely by the resistance which a scalpel meets, for the spinal cord, in general, is so soft that the slightest force will divide it. Where these morbid changes have taken place, there, as a rule, red softening is observed in some part of the cord itself. The most striking lesions of the cord are found in Pott's disease, where an angular curving of the cord has taken place in consequence of a similar curving of the spinal column from destruction of the bodies of the vertebræ. The cord at the angular spot is dense, flattened, and somewhat yellow, or more reddish-colored than elsewhere; sometimes complete solution of continuity is observed.

Symptoms.—In the new-born child, hæmorrhages and inflamma-

tions within the spinal canal furnish no characteristic symptoms, for the tonic and clonic spasms then observed occur even more frequently without any demonstrable lesions of the spinal cord. The symptoms belonging to these conditions can be studied to better advantage in children with spina bifida, the sac of which is ruptured, or in a gangrenous condition. Such children are attacked by intermittent spasms of the dorsal muscles, which may be transient, and only of slight degree. Sometimes, however, they take the form of the most violent and protracted opisthotonos. Touching the spinal column in these patients always causes excessive pain, and induces new spasms, and, for this reason, it is well to keep them constantly upon the side. Severe pains are also produced by touching either of the lower extremities before they become paralyzed. Motion aggravates the pain excessively, and induces new spasms. Finally, paralysis of the lower and then of the upper extremities supervenes, occasionally alternating with spasmodic convulsions, and death ensues, after a few days, from trismus and tetanus. In older children, well-pronounced spinal symptoms are distinctly seen in caries of the spinal column, and as sequelæ of scarlet and typhus fever, where complete paralysis of the lower extremities remains. The patients describe very distinctly a sensation as if the limbs were covered with fur, or of ants creeping upon them; the sensibility of the integument is diminished; severe pain, however, is complained of, if much force be applied. Sometimes convulsive twitchings take place, soon followed by total paralysis. The process at first runs a febrile course, i. e., with a frequent pulse, hot skin, noticed most markedly on the back. This fever soon subsides, but the paralysis continues for many months, and perhaps during life. The rarer phenomena noticed in this malady are: disturbances of the sensibility of the skin, difficult deglutition, palpitation of the heart, attacks of dyspnoea, singultus, priapism, etc. In this connection, the paralysis and convulsions are briefly considered, because the symptoms are often found to exist without any demonstrable lesion of the spinal cord, and their practical importance will be considered farther on in a special section. Inflammation of the spinal cord occurs almost always in a sporadic form; still, according to *West*, it has been observed as an epidemic in France, between the years 1842 and 1844, and lately in the hospitals and workshops of Ireland. Although very decided quantities of serous effusions were found between the meninges, still the cord was rarely and but very little altered. The disease ran a very acute course, and terminated fatally in from one to four days. In regard to the differential diagnosis between inflammation of the spinal cord and that of the membranes, a rule has been established that the first runs a chronic course, without any febrile movement,

and with a predominating paralysis, while the latter begins with active symptoms; fever and general convulsions and paralysis subsequently become superadded. As has already been observed, both diseases, more or less developed, run their course together, and it is therefore impossible, and, in fact, useless, to seek for differential signs.

Therapeutics.—An antiphlogistic, methodical treatment can be applicable in the rarest instances only, for the reason that the patients are too young, or, if advanced in years, have been so reduced by the preceding affections which are the fruitful cause of disease of the cord, such as spondylarthrocace, and scarlet or typhus fevers, that they do not tolerate an antiphlogistic treatment. In the early stage of the disease, fever and convulsions are best treated by small doses of calomel. An infusion of arnica-leaves may be given when the first violent symptoms have been palliated, but it is not possible to say that any beneficial effect will be derived from it. The paralysis that usually remains offers no very unfavorable prognosis, for, with the increase of bodily strength, improvement, if not complete recovery, may take place. Cold douches to the back, and the administration of strychnine, are important adjuvants; with the last remedy, however, we must never exceed one-eighth, or, at the most, one-sixth of a grain pro die, as otherwise symptoms of sudden poisoning are apt to be induced. The bladder should be constantly looked after, and the catheter used, if its contents are not voided for more than twelve hours.

(2.) SPINA BIFIDA. HYDRORRHACHIA. (*Hiatus Spinalis Congenitus*).—By hydrorrhachitis is understood a congenital tumor on the vertebral column, generally situated in the sacral portion, and produced by a protrusion of the meninges of the cord through a bony aperture in the spinal canal.

Pathological Anatomy.—Several degrees of this deformity may exist, and are known as follows: The defect may be confined to a portion, or include the whole canal. A total splitting of the vertebral column is only met with in monsters, hemicephalia, etc., and therefore does not come within the domain of clinical investigation; but defective formation of individual vertebræ does not produce a condition incompatible with life, and must be more carefully studied. Here also we have marked gradations in the extent of the malformation. In the mildest grade of the disease the laminae are imperfectly developed, or, being normal, the spinous processes are not united, and exhibit a *narrow fissure* between them. Again, the spinous processes may be entirely absent, or the bodies of the vertebræ are separated, and a *wide fissure* is seen to extend through the entire thickness of the spinal column. Lastly, in the extreme cases, *the fissures are still wider*, and several of the vertebræ are in a rudimentary state. If the

tumor itself be examined, the sac will be found to be continuous with the dura mater and arachnoid membranes of the cord; the integument covering the tumor is of a normal character, or atrophic, and semi-transparent, or it may be absent. In the latter case doubtless it was ruptured *in utero*, or during labor, and is found hanging in loose folds about the fissure. Where the membranes have remained entire, the tumor, during life, is tolerably tense, and fluctuates, while in the cadaver it is collapsed and flabby. Its contents are the liq. cerebro-spinalis. It varies in size from that of one scarcely perceptible to the touch, to that of a tumor the size of a hen's egg; is usually situated in the lumbar region, but may extend throughout the entire column. The cord itself may be normal, or, if the tumor be situated low down in the lumbar region, it may be spread out tuft-like upon the inner wall of the sac.

Symptoms.—These have been pretty well considered objectively. In shape, the tumor is oval or pyriform, sometimes pediculated; the integumentary covering is discolored and red; distinct radiating cicatrices are often observed on the flattened tumor, probably due to laceration of the sac, and subsequent union during foetal life. By pressure, the tumor becomes somewhat smaller; if a second sac exists, or when it is complicated with a congenital external hydrocephalus, the latter will become more tense. Pressure upon the tumor is extremely painful, and often produces tetanic spasms. In large tumors with atrophic coverings, movements synchronous with the respirations may also be distinguished, the tumor increasing during inspiration, and diminishing during expiration. On examining the margins of the tumor, the fissure in the vertebræ, with its upper and lower angle, and leaf-like dilatation at the centre, will readily be detected. The subjects are mostly born alive, but very rarely live longer than a few days. The tumor often bursts during delivery, sometimes becomes gangrenous without rupturing; the integument rarely retains a normal character, and subsequently becomes thickened. When air enters the tumor, or when the latter becomes gangrenous and bursts, purulent meningitis is apt to supervene, and will quickly terminate fatally. If a small tumor exists, and the integument remains intact, the patients may thrive; but paralysis of the bladder, rectum, and of the lower extremities, is apt to ensue, and result in death. Yet, cases are reported of individuals, thus affected, enjoying comparatively good health for twenty or thirty years. In the higher grades, the disease rarely exists by itself, but is complicated with congenital hydrocephalus, ectopia of the bladder, of the heart, club-feet, etc.

Chaussier has shown, by the statistics of the Maternité, at Paris, that one case of spina bifida occurs in one thousand births.

These tumors are not easily confounded with any other variety of tumor, as the vertebral laminae may be felt to be ununited in every true case of spina bifida. Rare instances of congenital hernia dorsalis, cysts, adipose and honey-like tumors (Honiggeschwülsten), are reported as curiosities in medical literature, as having been met with upon the spinal column, and calculated to mislead one into regarding them as cases of hydorrhachis. The extraordinarily rare condition of intrafoetatio, a foetus within a foetus, where a large formless tumor with a few bones is found situated upon the sacrum, has naturally no analogy whatever to the condition under consideration.

Therapeutics.—Surgeons have tried countless varieties of methods with the hope of bringing about a diminution of the tumor, and closure of the spinal canal. The almost invariable failure of all surgical procedures is due to the fact that the inner wall of the sac is formed by the spinal arachnoid membrane, and that any injury of this membrane is apt to produce meningitis, which cannot be limited to the sac. The tumor has been repeatedly punctured with exploring trocars and pierced with needles after forming valvular openings in the integument. Lately *Gaupp* presented a boy seven years old, who had a hydorrhachis the size of a child's head, which he had cured in the first few weeks of infantile life by puncturing it eight times. After the first puncture, the fissure of the vertebræ could be distinctly felt, but the gap rapidly diminished, and finally closure took place in ten weeks. All the parts constituting the vertebræ are now present in this boy, but the spinous processes are somewhat flattened. Excision, with the subsequent use of compression by quills or small wooden rods, has been tried. *Chassaignac* treated these cases by puncture and injecting iodine, as in a hydrocele, and the pediculated variety has been tied off. Finally, constant, steady pressure upon the tumor by a hair pillow has been tried, but, although this method caused great pain and convulsive twitchings, it did not effect a single cure. All experimenters have been obliged to acknowledge that their efforts have failed, nay, still more, that meningitic symptoms, which are always followed by death, came on immediately after the operation. Though the prognosis of hydorrhachis is at best very unfavorable, most children dying even without operation, still, owing to the rarity of this condition, statistics upon this point are scarce, and it is therefore difficult to determine which of the two courses it is best to pursue.

The most rational treatment, it seems to me, is to protect the sac from all kinds of injury and pressure, by a soft, cup-shaped pad which will only rest upon its margin, and which is secured to the body by elastic straps. If the hydorrhachis is complicated with congenital hydrocephalus, as is frequently the case, then no other means

should be adopted than that just described, for every diminution and compression of the tumor causes tension within the head.

C.—DISTURBANCES IN THE NERVOUS FUNCTIONS.

A number of functional diseases of the nervous system are probably only symptomatic of morbid alterations of the brain and spinal cord, if we may judge from the analogy between their individual phenomena and those of diseases whose pathological alterations are known. The corresponding morphological or chemical alterations of the nervous centres, however, have not yet been demonstrated, which is attended with great difficulty on account of the circumstance that most of these nervous diseases terminate favorably, and *post-mortem* evidence, therefore, is rarely attainable. As the demonstration of the cerebral morbid processes has not yet been accomplished, we have no other resource but to assume that the brain and spinal cord are in a normal condition, and to delineate symptomatically the individual phenomena, with their acquired denominations.

(1.) ECLAMPSIA INFANTUM (CONVULSIONS).—Convulsions in children have long been well known, even to the laity, and form an important class in the diseases of children. They are known by many names: tremor of the head, silent tremor, silent wail, shudderings, spasms, and cramps. These all refer to the same disease, and are characterized by general or partial clonic twitchings of the muscles, and generally caused by some other febrile disease. Consciousness is almost or wholly gone, particularly when the convulsions are general. The single attack cannot be distinguished from an epileptic attack, but epilepsy is characterized by its chronic course and unexpected recurrence, and freedom from fever. From chorea, eclampsia is distinguished by the fact that the muscular contractions in the former continue incessantly throughout the day, and even for several weeks before the affection is relieved, and that the general condition is not affected by it. As regards the period of life at which convulsions most frequently occur, childhood, up to the completion of the first dentition, is the most common; still, even older children, who at an earlier age have suffered from eclampsia, are attacked with violent convulsions at the commencement of an acute attack of an exanthema, even of an angina, or from an overloaded stomach. The milder, partial tremors in most instances last for several days, and reoccur frequently, especially in young children, in consequence of disturbed digestion. The general convulsion, to which alone the term eclampsia ought to be restricted, is not a protracted affection, it being either terminated in a single attack, or, after several paroxysms, always at certain intervals.