

electric excitability may be heightened, under others lessened, but this lowering of electro-contraction becomes more decided the more nearly the paralysis approaches the "spinal" character, which is the case in lesions of the cerebral peduncles, of the pons, and of the medulla. Immediately on the receipt of the injury done by the hæmorrhage, the sensibility is paralyzed with the motion, but the sensibility is soon restored, as a rule, although sometimes the restoration is very gradual, and it is rare for it to be complete. Anæsthesia and analgesia do not accompany lesions of the corpus striatum, whence it happens that these functions are so seldom permanently impaired in hemiplegia. In some cases—lesions of the thalamus, corona radiata, etc.—anæsthesia may be a constant symptom. Anæsthesia may be followed by hyperalgesia, and the paralyzed members may be the seat of neuralgia. Various *trophic* changes occur in hemiplegia. With the first hemiplegia, the paralyzed parts are usually somewhat swollen, are red, and possess a slightly higher temperature, and sweat a good deal. These symptoms subside in a few weeks or two or three months; the affected parts become cold, pale or bluish, the skin scaly and dry, and the nails grow wrinkled, thickened, brittle, and incurved, and the hair changes in texture and length. The skin grows thicker and tougher in many cases, and the larger joints may be the seat of an acute synovitis. In addition to these trophic affections should be mentioned the fact that the paralyzed members in hemiplegia rapidly ulcerate by pressure (bed-sores).

Course, Duration, and Termination.—In the fulminant form death may occur in a few minutes, never less than fifteen. There may be a partial revival, the consciousness restored more or less completely, and then a new attack occurs, closing the scene usually in a day or two. The apoplectic symptoms having disappeared, the next danger consists in the inflammation about the clot, the febrile excitement, headache, and delirium, which usually prove fatal within a week, unless very mild and transitory. Having passed this period there is a partial recovery with hemiplegia, which may gradually disappear, leaving but slight traces of the original mischief. There are but few if any who are restored entirely in all their mental powers, although the motor paralysis may have ceased. If changed in no other way, they are emotional, easily excited to tears, or become altered in disposition, appearing irritable, excitable, peevish. Usually memory is impaired, especially for the events of the time, while matters long past of early life may be vividly recalled. The memory for words may be impaired slightly, may be very defective, or may be entirely lost, constituting the condition of aphasia. This may include inability to express ideas by signs. There may be a gradual decline in the mental powers, the patient lapsing into dementia. The duration of a case of hemiplegia is very uncertain—many continue for ten, fifteen, even twenty years. But hemiplegics

are always threatened by a new attack, since the lesions which originally caused it are yet present. Another attack or two is the usual course, proving fatal ultimately unless cut off by an intercurrent disease.

Diagnosis.—As the subject of the distinction between occlusion of the cerebral vessels and cerebral hæmorrhage has been discussed, it remains now to indicate the seat of the lesions by the symptoms. The diagnosis of the position of the hæmorrhage by the symptoms rests on the knowledge of cerebral localizations. Lesions of the cortex and of the medullary substance of the hemispheres give rise to paralysis on the opposite side of the body. If slight in extent, recovery may ensue. A lesion confined to the third left frontal convolution has produced aphasia only. Disturbances in the mental functions are usual and are more decided than the psychical symptoms produced by cerebral hæmorrhage into other parts. Hæmorrhage into the anterior lobe causes paralysis of the opposite half of the body, and aphasia if the left is the seat of the lesion. Hæmorrhage into any of the parts supplied by the left middle cerebral artery will produce disturbance in all the modes of expressing ideas by words and signs. Sensibility as well as motility is disordered in hæmorrhage into the posterior middle lobe and into the posterior lobe. Disturbances of vision and optic neuritis accompany the paralysis, and psychical disorders, with a special tendency to emotional manifestations, are pronounced features. Hæmorrhage breaking into the ventricles is accompanied by formidable symptoms; by deep coma, sometimes by convulsions, partial or general, occasionally by contractions of the paralyzed parts, by unequal pupils, one being widely dilated. Hæmorrhage into the corpus striatum, the most usual site of cerebral hæmorrhage, is followed by paralysis of the members, body, and face on the opposite side; and, if in the left corpus striatum, affections of speech, sometimes complete aphasia, are usually present. There are no disturbances of sensibility in these cases of hemiplegia from hæmorrhage into the corpus striatum. As the optic thalami have never been invaded by hæmorrhage strictly limited to them, the results of lesions are hemiplegia of the opposite side and affections of sensibility. It is probable that the motor symptoms are due to simultaneous injury to the corpus striatum. Hæmorrhage into the pons or medulla is very fatal—in from fifteen minutes to several hours. There are convulsions usually, general muscular resolution, and minutely contracted pupils. If the immediate results are passed over, various motor disturbances ensue: there may be paralysis of both sides, or paraplegia, paralysis of one side, or hemiplegia; paralysis of the members on one side and of the face on the opposite side, or crossed paralysis; also sensory disturbances: there may be anæsthesia with the paralysis of one side, and the paralysis of sensation may be "crossed," as is the motor paralysis.

Treatment.—If the prodromal symptoms threaten an attack of cerebral hæmorrhage, venesection, as the most prompt and efficient means for reducing the intra-cranial blood-pressure, should be at once practiced, the amount drawn being decided by the effect produced. In feeble subjects, leeches to the mastoid may be substituted for venesection. An active purgative (compound extract of colocynth gr. vj, croton-oil gt. j) should be administered. Counter-irritants should be applied to the extremities, and an ice-bag to the scalp. If the hæmorrhage have occurred, these measures will be useless. The utmost quiet should then be maintained, the head elevated, the room darkened. Excellent results are then obtained by the use of tincture of aconite-root, beginning immediately after the coma has passed off. One drop every two hours will usually suffice, as it is not necessary to reduce the pulse by it, unless the reactive fever is considerable, when the dose mentioned may be given every hour for a day or two. When the reaction period has passed, or at the end of two weeks, much may be accomplished by the judicious use of ammonia (ammon. carb. gr. v, liq. ammonii acetat. $\frac{3}{4}$ ss., four times a day), continuing it for a month or more, or until the retrograde changes in the blood-clot are accomplished. Then the time has arrived for the application of galvanism, a weak current—say from four cups—being passed through the brain in both directions, or from behind forward, and from both mastoids. The application should be daily, and for three minutes at a *séance*. To assist in the restoration, the lactophosphate of lime (sirup) should be administered three times a day with the meals, and the diet should be nourishing and yet unstimulating. As the tendency of paralyzed parts is to waste, the members should from the beginning be subjected to daily massage, at first very lightly, and, if wasting of the muscles is considerable, they should be exercised by faradization. If there is much contraction of the flexors, the extensors should be faradized, and the flexors should receive a continuous mild current to allay their irritability. When there is no longer any local irritation about the site of the hæmorrhage, the injections of strychnine should be practiced into the affected muscles. During the long period after the absorption of the clot, when the paralysis remains stationary or slowly improves, good results are obtained from the persistent use of lactophosphate of lime and cod-liver oil, which act as nutrients to the cerebral matter. These may be given when electricity and the injections of strychnine are practiced.

CEREBRAL HÆMORRHAGE—MENINGEAL.

Pathogeny.—Hæmorrhage into the meninges may be caused by injury; as, for example, the meningeal artery may be ruptured by a fracture, involving the anterior inferior angle of the parietal bone.

The most usual cause, probably, is aneurism, and the vessel most frequently the seat of this disease the basilar, except the meningeal hæmorrhage of newly-born children, which is really traumatic, and produced by forceps delivery. Meningeal hæmorrhage is a complication of the acute infectious diseases. The blood is found in a thin layer, under the dura or in the cavity of the arachnoid, at the base on the hemispheres, and in both situations at the same time. The brain itself may be injured by the escape of blood from an aneurism, and the convolutions may be depressed, the brain-substance pale and sanguine.

Symptoms.—As meningeal hæmorrhage occurs in the adult, the phenomena attendant on it are the same as those of a large cerebral hæmorrhage. There are coma, complete muscular resolution, often succeeding to convulsions of an epileptiform character, pupils unequal, and reflex movements entirely suspended. Death may occur in a few minutes, or after several hours, in profound coma. In other cases there are headache, dizziness, nausea, and vomiting, drowsiness, passing into stupor, then coma until death after some hours—symptoms supposed to be due to the gradual escape of blood from a ruptured vessel. In new-born children meningeal hæmorrhage is a common cause of asphyxia, from which they can not be roused.

INFLAMMATION OF THE DURA MATER—PACHYMEMINGITIS EXTERNA AND INTERNA—HÆMATOMA OF THE DURA MATER.

Definition.—By *pachymeningitis* is meant an inflammation of the dura mater. As this membrane consists of two layers, there are two forms of the inflammation attacking it: *pachymeningitis, externa* and *interna*. *Pachymeningitis externa* is a surgical malady—an inflammation of the external lamella of the dura, excited by fractures, penetrating wounds, and other injuries of the skull, and by caries of the petrous portion, involving the dura by contiguity of tissue. The last-mentioned malady is so intimately associated with abscess of the brain that it is more appropriately studied in connection with that disease.

Causes.—*Pachymeningitis interna—hæmatoma of the dura.*—Age is an important factor, the tendency to this disease increasing from twenty upward, the largest number *per centum* occurring from seventy to eighty (Huguenin). Three fourths of the cases happen in men, doubtless because they are more exposed to the influences producing this disease. Trauma plays an important part, with or without fracture of the skull. In one of the author's cases the hæmatoma followed a blow on the head—a contusion—with the handle of a heavy riding-whip. No doubt the blow which causes the mischief often is forgotten, and some other cause assigned. A predisposition may be

created by several morbid states: by chronic alcoholism, scurvy, pernicious anæmia, Bright's disease, sclerosis of the liver, diseases of the heart, and obstructive maladies of the lungs. Atrophy of the brain, caused by various intra-cranial lesions, seems to be a very important factor in the development of hæmatoma (Huguenin), and to this may be added, by way of illustration, the atrophy of advanced age and of chronic alcoholism.*

Pathological Anatomy.—The most commonly accepted view is that of Virchow. The first step in the morbid process consists in a hyperæmia of the membrane, and an exudation, developing into a membranous new formation, proceeds from the sub-epithelial layer of the dura.† This neo-membrane contains a multitude of vessels of considerable size, and having very thin walls. Hæmorrhages, often of considerable quantity, take place by the rupture of these vessels, and the size and thickness of the neo-membrane are correspondingly increased. Ultimately the new formation assumes the appearance of a cyst, having a smooth surface exteriorly, and containing within a cavity lined with blood-clot, shaggy masses of fibrin, partly decolorized, hanging from the walls, and a fluid reddish in color and thick with particles of broken-up clot. At a later period there may be no appearances of blood-clot, except, it is probable, some blood-crystals—there may be only a cyst, filled more or less full with a pellucid serum, or instead of a cyst with a single cavity there is a mass of connective tissue, its fibers loosely united, spongy, with serum more or less fully distending the interspaces. Before its nature was understood the cyst containing clear serum was called "cyst of the arachnoid." It should be understood that, between a sac filled with blood-clot and one containing serum only, there are various intermediate grades, the blood being more or less advanced in the process of disintegration, by which all the morphotic elements are dissolved and decolorized. Huguenin ‡ holds that the formation of a hæmatoma is not initiated by an inflammation of the inner lamella of the dura, but that the process consists merely in the organization of a hæmorrhagic extravasation. An immediate vascular communication is established between the dura and the new membrane. The usual position of the new formation is on the upper surface of the hemispheres, extending downward toward the occipital lobe, corresponding to the parietal bone, and in more than half the cases on both sides. The changes in the adjacent portion of the brain are dependent on the size and thickness of the neo-membrane. In a case observed by the author the cyst was a half-inch in thickness at its thickest part, and it depressed the hemisphere correspondingly, the convolutions being flattened, the sulci almost obliterated, and the ven-

* Dr. Jacob Kreminansky, "Ueber die Pachymeningitis interna hæmorrhagica bei Menschen und Hunden," Virchow's "Archiv," Band xlii, S. 129-321.

† Rindfleisch, *op. cit.*, p. 620.

‡ Ziemssen's "Cyclopædia," vol. xii.

tricle lessened one half of its area. Atrophy of the brain, atheromatous degeneration of the vessels, and the alterations in the structure of the brain, accompanying dementia paralytica, are often present. Obstructive diseases of the lungs and valvular affections of the heart are frequently associated with and apparently have a causative relation to this malady.

Symptoms.—There is necessarily much obscurity about this disease, and the symptoms are diffused, and but little characteristic. There occur first the indications of excitement of function, followed by those of depression. In the first group are an obstinate headache, vertigo, ringing in the ears, contraction of the pupils to a marked extent, uncertainty and feebleness in the movements, without paralysis, wakefulness, and when sleep comes it is disturbed by exciting dreams. In some cases, but less frequently, there occurs an attack, apoplectic in character and with the usual phenomena of that state. The period of excitation continues from a few days to three months, and is succeeded by the signs of cerebral depression. At this point in these cases there will usually occur attacks like those of cerebral hæmorrhage and from the same cause, but in this stage of this disease they are apt to pass slowly into unconsciousness. Death may occur in this coma, or the patient emerges from it slowly, when there will appear the symptoms due to the hæmatoma now produced. It should be remembered that this new formation is on the surface of the hemisphere, that there has been no destruction of the cerebral tissue as in cerebral hæmorrhage, and that compression is exerted by it on the brain-mass on one or both hemispheres. The symptoms now present are persistent headache, contracted pupils, and paroxysmal attacks of somnolence, persisting for days at a time. If the pressure is on one side only, the corresponding pupil is smaller. Paresis of the muscles, contractions, twitching of the muscles, are observed on one side when the lesion is unilateral, or they may be double. Convulsive movements, limited to a hand, or arm, or leg, may be observed. Hemiplegia may slowly develop out of a unilateral paralysis. After existing on one side for a time, these motor disturbances may slowly affect the other side, doubtless because of an extension of the disease. In one third of the cases there are defects or embarrassment of speech, but rarely complete aphasia. There are not any disorders of sensation. The pulse is usually weak, rapid, and rather irregular. Fever has been noted in many cases. The pulse may be slow during the hæmorrhage.

Course, Duration, and Termination.—The first stage, or that of excitation, usually lasts but a day or two, yet in exceptional cases it may continue a month or two. Death may occur in the apoplexy. The period of depression lasts usually from a week to one month, and may continue a year, but the most common duration is about twenty days. Although death is the usual result, recovery may take place, but it is doubtful whether the mental faculties are ever again entirely restored.

Treatment.—The remedial management of this disease is a discouraging undertaking. The usual remedies for cerebral hyperæmia may be used for the symptoms of excitation.

ACUTE HYDROCEPHALUS—INFLAMMATION OF THE PIA MATER: LEPTOMENINGITIS.

Definition.—The term *hydrocephalus* signifies water in the brain, but is restricted to a disease characterized by the presence of a serous fluid in the arachnoid spaces, in the pia mater, in the brain-substance (œdema), and in the ventricles. Hydrocephalus may be congenital or acquired. In this form—the inflammatory—the presence of water is due to an acute inflammation of the *pia mater*, but without tubercle—leptomeningitis. Hydrocephalus is a general term which serves to unite various conditions, but it is always a symptom.

Causes.—Mechanical causes, which prevent the return of blood from the vena Galeni and the right sinus, will induce effusion into the ventricle. Intra-cranial tumors, bands of false membrane, obstruction of a sinus or tumors of the neck so situated as to compress the jugular vein, belong to this category. Disease of the right heart, obstructive diseases of the lungs, as emphysema, sclerosis, etc., may cause hydrocephalus by mechanical interference with the circulation. In advanced age, ventricular dropsy occurs in consequence of atrophy and shrinking of the brain. Various cachexiæ affect the intra-cranial circulation and cause dropsy, as Bright's disease, cancer, tuberculosis, etc., but only the first-named stands in a causative relation to the form of hydrocephalus here considered. Dropsy of the ventricles coincides with general dropsy from cardiac and renal diseases. Leptomeningitis is a disease of early life, from one to five years of age, but it may occur at any age. Unfavorable hygienic conditions increase the tendency to it, and the predominance of the nervous system in the bodily conformation invites this, as other forms of nervous disease. Both sexes are affected alike. Among the exciting causes may be mentioned dentition, the eruptive fevers, and blows on the head.

Pathological Anatomy.—The effusion is usually confined to the ventricles, but there may be considerable distention of the subarachnoid spaces, œdema of the pia and of the neighboring portions of the brain. When the effusion is limited to the ventricles, the brain-tissue is found to be moister from the gray matter inward. More or less softening by imbibition exists for a short distance from the ventricles. The choroid plexus is hyperæmic, and may contain minute extravasations. The ventricles are usually symmetrically dilated, but, in the hydrocephalus of the aged, one ventricle may be very much dilated and the other encroached on and narrowed.

Symptoms.—There are several modes of onset, and several types of cases, as the causes sufficiently indicate. One variety, known as "serous apoplexy" by the older writers, begins, by reason of a sudden effusion, very abruptly, with the phenomena of apoplexy: there are unconsciousness, muscular resolution, immobile pupils, involuntary evacuations. In the midst of the coma there may sometimes arise delirium. So extreme may be the pressure of the fluid that the medulla oblongata ceases to functionate, and the patient dies in a few hours, and rarely is life prolonged several days. The next type may be characterized as the *convulsive*. This begins with the symptoms of excitation, and there may be some feverishness, headache, nausea, and vomiting, for a few days, when an attack of eclampsia occurs, or the convulsion may be the initial symptom, or in adults a violent delirium. These symptoms are soon followed by depression, and the patient passes into a stupid, somnolent state, is roused with difficulty, and weakness of the members is succeeded by complete paralysis. Very unexpectedly, sometimes, the consciousness revives, but for a brief period, and the coma comes on again, death soon occurring. This form usually appears in the course of Bright's disease or general dropsy. The ordinary form in children sets in with feverishness, headache, intolerance of light, and corrugation of the forehead; intolerance of sounds, restlessness, delirium toward evening, wakefulness, or disturbed sleep; vertigo, twitching and spasmodic contraction of muscles (head drawn back, fingers and toes incurved); great sensitiveness of the skin, pain being caused by a slight touch, especially about the neck; nausea and vomiting without cause, the belly drawn in, and obstinate constipation. Such symptoms will continue for several days, when there will occur convulsions of an epileptiform character, or partial convulsive movements in an extremity, in the muscles of the abdomen, or in the face. The temperature may rise very high during these convulsive attacks—the pulse rapid, and often irregular—but the temperature declines after the eclampsia has ended. Death may take place at this period, or, as is most usual, the epileptiform attacks cease and the ordinary course of the disease is resumed. The symptoms of depression now come on: restlessness is replaced by stupor, rigidity and contraction of the muscles by paresis, heightened sensibility by anæsthesia. The pupils dilate somewhat and become less and less mobile, and are often unequal in size, and double vision is noticed. The pulse declines in force, and exhibits a marked degree of inequality, now beating at 80, now at 130. The respirations become irregular in rhythm, and manifest the Cheyne-Stokes type to some extent. The surface becomes cool; the fontanelles are prominent and rounded; and the sutures in young infants separate somewhat. The vomiting continues, and the nutrition is greatly impaired. The patient sinks into a deep coma, and, although there occur remissions, in which the unconsciousness seems less profound, the

pulse and breathing better, and the reflex movements more easily excited, they do not persist.

Course, Duration, and Termination.—A few cases have been reported cured. They were milder examples of the common type, as seen in children, and, although the symptoms of excitation were well marked, those of depression did not come on. The appearances of improvement, which are observed in the stage of depression, are illusory. The apoplectic and convulsive forms are always fatal in a few hours or two or three days; the common form very rarely terminates in recovery. The duration of the cases terminating by exhaustion is very protracted, reaching to four, six, even eight weeks, but the average duration of these cases is about three weeks. Those ending by convulsions do not often continue beyond two weeks. The extended duration of some cases is due to the absence of convulsions and the prolongation of the stage of coma. As the questions connected with diagnosis and treatment are the same as for tubercular meningitis and for simple meningitis, they are postponed for separate and full consideration at the conclusion of the subject of meningitis.

CHRONIC HYDROCEPHALUS.

Pathogeny and Symptoms.—*Chronic hydrocephalus*, as it occurs in children, usually succeeds to the acute form, and is a result of rickets, or an accident of the rachitic constitution. The quantity of fluid is much greater, however, in the acute form. After youth, the accumulation of fluid is due to the pressure of tumors on the straight sinus, vein of Galen, etc., and in old age considerable effusion is produced by atrophy of the brain. In dementia paralytica, there may be considerable distention of the ventricles and of the perivascular lymph-spaces. The initial symptoms are those of irritation, and are due to the presence of the new vascular conditions, but, as the effusion grows, the neighboring parts are pressed upon, and the symptoms of depression then dominate the situation. Hebetude of mind, stupidity, diminished activity of the special senses, and a fatuous expression of countenance, are now observed. General sensibility—tactile, heat, cold, and sensory—is much less active than normal. Motility is also impaired, especially in the distribution of the seventh nerve: there are present ptosis and a blank expression due to relaxation of the muscles of expression. The pupils are unequal, and respond sluggishly to the action of light. The tongue is paretic, and the speech thick and utterly unintelligible. The faculties continuously decline into idiocy or dementia; locomotion becomes impossible; control of the sphincters is lost; sight and hearing are abolished. This slow decline may be diversified by convulsive seizures, or more acute symptoms may be produced by a sudden and large effusion. In the

latter, unconsciousness may occur, preceded by violent headache, and followed by inequality of pupils, hemiplegia more or less complete, slow, irregular pulse, impaired articulation, aphasia, etc. The duration of the cases is measured by months, and the termination is fatal. The fatal result may be caused by the ordinary progress of the disease—the compression of the increasing effusion, or by some intercurrent disease, as pneumonia, pleuritis, meningitis, etc. The treatment is the same as for the congenital form, to which the reader is referred.

CONGENITAL HYDROCEPHALUS.

Causes.—Much obscurity obtains on this point. Imperfect formation of the cranium and defective development of the brain are influential causes. A chronic inflammation of the ependyma seems to develop the disease sometimes. Again, it is the product of purely mechanical agencies, such as the compression, by a tumor, of the straight sinus or of the vena Galeni.

Pathological Anatomy.—There is no constant ratio between the size of the head and the amount of liquid present. The fluid may vary from an ounce or two to sixteen ounces or more. The liquid is transparent, of a straw-color, and contains but little solid matter, which consists of albumen and chloride of sodium. If the fluid is considerable, the ventricles are much distended, the optic thalami and the corpora striata are depressed and flattened, the orifice between the two ventricles is very large, and the roof of the ventricles is thinned according to the amount of fluid, and may be to the extent that only a mere line of white and gray matter remains. From this extreme distention to the mere filling of the ventricles without disturbing the harmony and proportion of parts, there are numerous variations in the quantity of fluid. The enlargement of the head caused by the effusion may be sufficient before birth to impede or prevent natural delivery. The degree of ossification is an important element in the dimensions. The bones are so thinned as to be translucent; the fontanelles and the spaces between the sutures are very wide; the lateral portions of the cranium project greatly; the forehead bulges out enormously over the eyes; the orbital plates are depressed, whence the eyes are forced forward between the lids, producing the condition of exophthalmus.

Symptoms.—The dimensions of the head at first attract attention to the condition of the infant. At the period when the head should be held erect it is found to droop, resting on one or the other shoulder. Then it is noticed that the mental development does not grow with the physical; that the face is devoid of expression; that the attention is not attracted by surrounding objects; that voluntary movements are slow of execution. When the period for standing on the feet and making attempts at walking arrives, the power to maintain the erect