

dura is reddened, and the inflammation may extend along the sheaths of the nerves and into the substance of the cord, although there are cases in which, with extensive involvement of the pia-arachnoid, the cord escapes completely. Usually there is a perivascular infiltration with leucocytes and phagocytic cells, and a swelling and proliferation of the cells of the neuroglia. Klebs, Zenker, Strümpell, and Barker all describe accumulations of leucocytes in the cord, forming in some cases focal abscesses. The changes in the nerve cells, shown by the Nissl stain, are peripheral chromatolysis—characteristic of all toxic conditions—and central chromatolysis—characteristic of injury to the axone of the cell. Sections treated by Marchi's method may show degenerated fibres, especially in cases of long duration.

Congestion and œdema of the lungs is a frequent complication. Pneumonia, either primary or secondary, and usually lobular, is also frequently present. Councilman found in one case that the process in the lung was due to a purulent embolus from the meninges lodging in a small branch of the pulmonary artery. The liver and kidneys usually show only acute parenchymatous degeneration, the intestinal tract is usually not affected, but may show swelling of the follicles, and the spleen is only exceptionally enlarged. Endocarditis and pericarditis may be complications.

**SYMPTOMS.**—There is seldom any real prodromal stage, though there may be one or two days of languor, headache, and slight chills preceding the onset of the disease. Usually this is sudden, ushered in by a severe chill followed by fever, vomiting, and headache. The course of the disease is so irregular that it is hard to give a description of a typical form, harder still to divide it into definite stages or definite varieties. Hirsch's classification into three forms, the malignant ("foudroyante"), the abortive, and the acute and subacute, is perhaps the simplest. The malignant form is characterized by its sudden onset, usually in a healthy person, and rapid development. Within a few hours vomiting, delirium, convulsions, rigidity of the neck, unconsciousness, and collapse may follow each other in rapid succession, and death has been known to take place in less than twelve hours. Several cases of less than twenty-four hours' duration are on record. These cases belong not to the sporadic but to the epidemic form, and are more apt to occur among the early than the later cases. A purpuric rash is often seen, which has led to the clinical names applied to this disease: "spotted fever," "malignant purpuric fever," etc. The second, abortive, form would be recognized with difficulty in the absence of an epidemic. More or less pronounced cervical rigidity with pain on motion, and severe, remitting headache may be the only symptoms present. It is apt to last only a few days, but there may be recurrences of rigidity and headache for some time afterward.

The third is the ordinary form, which usually begins more or less suddenly with headache, generally frontal and very severe. Vomiting is often an early symptom and a valuable aid in diagnosis. A more or less pronounced chill is followed by a rise of temperature to 101° or 102° F. The headache often increases in intensity, rendering the patient delirious, not from the meningitis but from the extreme pain. This is not, however, a gauge for the severity of the disease, for it may be very severe in patients who make a good recovery. It is subject to remissions and is apt to come on suddenly during sleep, making the patient waken with a sudden cry ("cri hydrocephalique"). The vomiting may return with the exacerbations of pain; usually it lessens as the disease progresses, but may be so persistent as to endanger the patient's life through excessive weakness. Dizziness, restlessness, sensitiveness to light and sound accompany the headache.

Rigidity of the neck is an early and important symptom, perhaps the most constantly present symptom of this disease. It consists of a tonic contraction, reflex, of the deep muscles of the neck, especially the splenius, is increased on active or passive attempts at movement, and

is accompanied with pain. In some cases the rigidity is so pronounced that by putting the hand under the patient's head his body may be raised from the bed without making the neck bend. Often the head is bent back, sometimes so far that the occiput lies between the shoulder blades. The rigidity does not, however, affect the side movements of the head. The pain may be constant, even more severe than the headache, or may be absent when the patient is perfectly quiet and there is no pressure on the neck.

There are also pain and sometimes rigidity all along the spine, increased on motion and pressure, and there may be lightning pains in the limbs due to irritation of the peripheral nerves. Flattening or retraction of the abdomen is not so frequent as in tuberculous meningitis. Traube has pointed out that it is due to a drawing together of the intestines from irritation of the vagus—which is also responsible for the vomiting—and not, as many suppose, to a contraction of the abdominal muscles. Constipation from tonic contraction of the bowels may persist throughout the attack; diarrhœa is rare.

Hyperæsthetic areas alternating with areas of normal sensation are most frequent over the lower extremities and involve both skin and muscles. In some cases this symptom is very pronounced, and even in deep stupor a reaction may be obtained by pressing the muscles of the legs. Anæsthesia is more apt to be a sequela.

The motor disturbances consist in the rigidity of neck and back already described, in tremors or even spasms of the muscles of arms or legs, occasionally of the face, in strabismus, difficulty in swallowing, and sometimes even trismus. Kernig's symptom is often present—a strong flexion of the knee caused by passive flexion of the thigh upon the abdomen. The patellar reflex may be increased or completely lost. Later on, these irritative symptoms may be succeeded by symptoms of paresis, though the latter more often appear as sequela. The most common forms are ptosis, dilated pupils, strabismus divergens, and paralysis of the facial muscles; much less common is hemi- or paraplegia.

The cerebral symptoms begin as delirium, passing into stupor or even coma. In less severe cases without delirium there are insomnia, restlessness, and irritability, confusion, dulness or excitability, perhaps hallucinations. Stupor is regarded as a serious symptom, being present almost always in the fulminating cases. The temperature curve is very irregular. In the very rapid cases it soon reaches a high point, 105°–106° F., and remains there for several days, either rising to hyperpyrexia (108°) just before death, or falling suddenly. In the more usual forms the temperature begins to sink after a few days and is then irregularly remitting, showing a great range within twenty-four hours, high fever, and entire absence of fever. Usually the febrile exacerbations tend to be less severe as the disease progresses, but this is not invariably true, and every rise of temperature must be regarded as serious. In atypical cases a regularly remitting fever with chills may simulate malaria; in others there may be a crisis on any day between the sixth and the tenth.

The pulse is usually rapid, especially in children. A very slow pulse is rare. In collapse the pulse is small and extremely rapid from involvement of the vagus, a serious symptom in adults. Heart complications are rare. The respirations may be increased in frequency, but are regular in ordinary cases. Irregular respiration is a graver symptom in adults than in children. In some instances there may be typical Cheyne-Stokes breathing.

The skin symptoms are very variable. Petechiæ seem to have been common enough, in the early epidemics, to give the disease the name of spotted fever, but in many of the later ones this symptom has been insignificant or absent. Roseolæ, like those of typhoid, scarlatinal eruptions, erysipelous eruptions, urticaria, erythema nodosum, even gangrene, have been observed. Herpes is present in the majority of cases, and is an important diagnostic symptom. It appears most commonly be-

tween the third and sixth days, on lips, nose, and cheeks; more rarely on the neck and body.

The urine is apt to be increased, often contains albumin, sometimes sugar. The diazo reaction is usually present.

Involvement of the special senses constitutes a grave complication. There may be complete loss of smell and taste. In the case of the ear the deafness resulting from inflammation of the labyrinth or from otitis media is apt to be persistent, and in young children results in deaf-mutism. Moos found thirty-five cases of deafness out of sixty-four cases of recovery from meningitis. There may be keratitis or even panophthalmitis from an extension of the inflammation along the sheath of the optic nerve, which may itself show an acute neuritis. Randolph examined forty cases in the Maryland epidemic of 1892, and found the fundus normal in only seven. Most of these thirty-three showed a venous congestion of the disc with remarkable tortuosity of the vessels, which sometimes looked quite black as if from complete stasis. Six cases had neuritis optica, one an acute retinitis. The right eye was by far the most frequently affected. The pupils are usually small at first, then there is often a unilateral dilatation, which is a valuable aid in diagnosis. As a rule, just before death there is extreme dilatation of both pupils.

Complications in the form of joint affections have appeared in certain epidemics: serous effusion into knees, ankles, and wrists. More rarely the exudation is purulent.

There is a question as to whether the pneumonia so often accompanying meningitis is to be regarded as a cause, a complication, or a sequela. Many observers have considered the meningitis as secondary to the pneumonia. In some cases this is indubitably true, the inflammation being caused by an invasion of the meninges by the pneumococcus; in other cases there has seemed to be a double infection, and finally Councilman declares the pneumonia, in the epidemic forms at least, to be secondary to the meningitis and caused by the entry of the diplococcus intracellularis into the lungs. He succeeded in isolating the organism from eight cases of pneumonia complicating epidemic meningitis.

Excessive anæmia and emaciation, even in robust young patients, forms a very serious complication in the more protracted cases. When the vomiting has been obstinate or the pain persistent and exhausting, it may reach as extreme a form as that of carcinoma or phthisis (Klebs). Undoubtedly many patients die of inanition in the later weeks of the disease.

There is usually a leucocytosis which may be very pronounced, and which is an aid in the diagnosis between this disease and typhoid fever.

**SEQUELÆ.**—Headache may persist for years, caused probably by areas of thickening in the pia mater. Deafness and blindness have already been referred to as deplorably frequent sequela. Loss of speech, independent of loss of hearing, mental feebleness, aphasia, and loss of memory are not so persistent, but tend to pass away slowly. Hemiplegic or paraplegic symptoms, paralysis of cranial nerves, also tend to clear up.

**DIAGNOSIS.**—In the absence of an epidemic this may not be easy. Any acute infectious disease in which the cerebro-spinal symptoms are pronounced may be, undoubtedly often is, mistaken for cerebro-spinal meningitis. The diagnosis between the epidemic form and the other forms of acute meningitis also presents difficulties, and is of special importance from the point of view of prognosis, for the epidemic form has the most favorable outlook. Tuberculous meningitis has a longer prodromal period, the symptoms are usually less acute, the fever not so high, and there are usually evidences of tuberculous lesions elsewhere in the body. The purulent forms due to infection by streptococcus or pneumococcus are said to be characterized by greater severity of the cerebral symptoms—delirium and coma—and by a less extreme rigidity of the neck (Leichtenstern). Quincke's lumbar puncture is a most valuable diagnostic

aid. Councilman says that the bacteriological examination of the fluid withdrawn is as important a clinical procedure as examination of sputum. His results have already been quoted. Lichtheim states that he has never failed to find tubercle bacilli in all the cases of tuberculous meningitis thus examined in his clinic. The presence of streptococci has been demonstrated in many cases, and according to Councilman and to Leyden and Goldscheider, these cases invariably prove fatal. The naked-eye appearance of the fluid withdrawn by puncture is also important. A large amount of fibrin indicates infection with the pneumococcus. Fluid withdrawn early in the disease is usually almost clear and contains only polymorphonuclear leucocytes; later on, epithelioid and large phagocytic cells are found (Flexner). In very rapid cases the fluid is not so abundant, and may be distinctly purulent. Lichtheim records a case in which the puncture yielded no pus, yet the patient died of secondary purulent meningitis, the pus being found in localized pockets. The puncture is best made between the second and third or third and fourth lumbar vertebrae, the needle passing in for a depth of 4 cm. in children and 7 or 8 cm. in adults. The great increase of pressure in the cerebro-spinal fluid makes aspiration usually unnecessary. It is a procedure often attended with beneficial results to the patient and seldom at all harmful. Lichtheim has, however, recorded two cases in which an exacerbation of the symptoms followed so immediately upon the puncture as to leave little room for doubt that they were caused by the puncture. Only one of the cases, however, ended fatally.

The differential diagnosis of this disease from typhoid fever depends, in cases in which the nervous symptoms are prominent, upon the great irregularity of the temperature chart in cerebro-spinal fever, the presence of herpes, the leucocytosis, and the detection of micro-organisms in the cerebro-spinal fluid.

Tetanus has symptoms of rigidity and muscular spasm much like those of the initial stages of cerebro-spinal fever, but tetanus begins without fever, trismus is an early and prominent symptom, the muscular spasms are more easily excited, the sensorium is intact, and there is absence of vomiting and headache.

Acute muscular or acute articular rheumatism, and especially rheumatism of the cervical muscles in childhood, may be hard to distinguish from meningitis, but there are no radiating pains, and the swelling of the joints in meningitis, if present, is a late symptom.

**PROGNOSIS.**—The mortality from this disease is usually high, although different epidemics vary greatly in this respect. According to Hirsch, the average mortality is thirty-seven per cent. for European, forty-five per cent. for American epidemics. It is said to be higher in the small epidemics. Councilman's figures for Boston were sixty-eight per cent., Flexner's and Barker's for Maryland only forty-eight per cent. Early childhood is bad; healthy young persons have the best chance. In all cases it is extremely difficult to give a prognosis, for the disease is liable to sudden fatal exacerbations at any time; while, on the other hand, the most serious cases, even the fulminating ones, may recover. Symptoms of depression, as coma or stupor, convulsions especially in adults, obstinate vomiting, very high fever, are all grave, while a long protracted case is apt to die from inanition.

**TREATMENT.**—In the early stages cold to the head and spine by means of ice bags and the ice coil, free diaphoresis and evacuation of the bowels, and perfect quiet, are all that is indicated in uncomplicated cases. Severe pain in the head or back often requires morphine, sometimes in large doses. Chloral seems to be well borne and is preferred by some clinicians. Local blood-letting by wet-cupping or leeches is said to afford relief in delirium with great congestion of the head. Bathing or cold packing or sponging is recommended by Osler, but strongly objected to by Leyden and Goldscheider, on the ground that the necessary moving increases pain and may cause unconsciousness. Counter-irritation is more valuable, in the later stages, for persistent headache, and may

be produced by a light application of the Paquelin cautery; blisters are no longer in favor. The same may be said for mercury, formerly so much employed. Iodide of potassium is still recommended by many writers. Landon Carter Gray advises combining it with ergot and quinine. Persistent vomiting is best treated by hypodermic injections of morphine, in cases which cannot be controlled by simpler remedies, such as iced champagne, sinapisms, etc. Surgical treatment (the removal of the arch of a vertebra, incision into the dura, and drainage) has not given encouraging results. The nutrition is of the greatest importance, especially in protracted cases. While there is still much fever, milk and broths are indicated; in the later stages and in the intervals between the exacerbations any light nutritious food may be given. Unfortunately there is often great difficulty in inducing the patient to take nourishment, and forced feeding may have to be used. As general tonics quinine in large doses, iron, the iodides, and belladonna have been recommended.

II. *Acute Secondary Leptomeningitis*.—This is distinguished from the form just described by the fact that it is secondary, not primary; according to many observers it is distinguished by the fact that it is caused by micro-organisms other than the diplococcus intracellularis Weichselbaum. These cases are very hard to distinguish from sporadic cases of cerebro-spinal fever proper, cases occurring in the absence of an epidemic. Councilman makes a sharp distinction between those sporadic cases which are proven to be due to infection by Weichselbaum's meningococcus, and the secondary cases which are caused by the pneumococcus, streptococcus, etc. Osler divides the meningitides into four classes: (1) Those due to the diplococcus intracellularis; (2) those due to the pneumococcus, which are usually secondary to pneumonia; (3) those due to the tubercle bacillus; and (4) those due to the streptococcus. Under this last head would come most of the cases which are secondary to otitis media, to mastoiditis, to erysipelas, to periostitis following trauma, to septicæmia, to ulcerative endocarditis, to extension from neighboring foci of suppuration, as pelvic cellulitis, suppurative pleuritis, etc., also the cases of meningitis complicating the acute infectious diseases. Exceptionally other micro-organisms are found in these secondary cases, as the typhoid bacillus, the colon bacillus, the staphylococcus pyogenes, and the gonococcus.

The extent of the disease is very variable. The suppuration may be limited to small foci or may form a general infiltration. The pathology is that of purulent inflammation, and does not need recapitulation. An extension of the process to the dura seldom occurs; the inflammation remains limited to the pia-arachnoid.

The symptoms are those of acute cerebro-spinal meningitis, complicated by the pre-existing disease. Headache, delirium, rigidity of the neck with or without retraction, high fever, vomiting, and convulsions, when developing in the course of an acute infectious disease, as a sequence of trauma or in a general septicæmia, would indicate an extension of the infection to the cerebro-spinal membranes. There may be trismus, epileptiform attacks, hyperæsthesia of the muscles and skin, twitchings or muscular spasms. As in the epidemic form, herpes is common. The temperature varies, but is rarely as high as in the epidemic form, and the pulse is apt to be slow. The pupils are at first contracted or unequal, later they are widely dilated.

The treatment is properly directed to the primary disease. For the cerebro-spinal symptoms the methods described above are to be tried, but the prognosis is very bad, such cases being almost invariably fatal.

III. *Acute External Meningitis, Acute Pachymeningitis, Acute Peripachymeningitis* ("Perimenigitis Aiguë").—By some authors these are considered two different affections, the latter involving the peridural connective tissue only, the former the dura itself.

"Perimenigitis" was first described and named by Albers in 1833 as a primary acute affection of the connective tissue surrounding the dura mater. He reported two cases. In 1879 Leyden proposed the name peri-

pachymeningitis, a name which has been generally accepted by the Germans, while the French have adhered to the original name. The disease is a rare one. Deléarde in 1900 reviewed the literature and collected sixteen cases, adding one of his own. Of these, fourteen were men, the larger number being between the ages of twenty and thirty, the exciting cause apparently exposure and overexertion. Autopsy revealed the presence of inflammation in the peridural tissue only, which sometimes extended to the tissues around the vertebral column, but was essentially primary in the connective tissue surrounding the dura.

The port of entry for the infection is unknown. The organisms isolated are the staphylococcus aureus in two cases (Antony and Netter), the streptococcus in one (Deléarde). As the dura is free from the vertebral column laterally and posteriorly, the inflammatory exudate tends to collect on these surfaces and may travel out through the intervertebral foramina along the spinal nerves, as in Meslier's case. The effusion may be serous and abundant, or fibrinous, forming a false membrane over the outer surface of the dura; or, especially in the very rapid cases, it may consist of a small amount of bloody pus. The extent of the exudate varies much. Usually the cord is softened at the point of greatest inflammation, but is normal above and below.

There are no pathognomonic symptoms. The onset is usually sudden, with pain in the limbs and paraplegia, but without spasm and with normal or diminished reflexes. Anæsthesia appears early, preceded by lightning pains, and usually there is a zone of hyperæsthesia just above the anæsthetic area. Pressure on the spine over the inflamed region is very painful. The general symptoms are fever with morning remissions and a typhoid condition. Death is preceded by a fall of temperature (89.6° F. in the rectum was noted in Lemoine and Lannon's case). Symptoms of internal meningitis, muscular spasm, rigidity of the neck, etc., appear late, if at all, and are evidences of an extension of the process to the pia-arachnoid. The rapid paralysis and anæsthesia without spasm or contraction are the chief diagnostic symptoms.

The prognosis is extremely bad. One case, that of Antony, operated on by Chiapault, who performed laminectomy of the seventh to the eleventh dorsal vertebrae, recovered temporarily, but soon succumbed to suppurative endocarditis. Usually death occurs early. Meslier's case, lasting eight days, is the longest in Deléarde's series. Asphyxia from paralysis of the muscles of the thorax is the most common cause of death.

Pachymeningitis or peripachymeningitis secondary to some inflammatory process in the body is, according to the authors quoted above, to be strictly distinguished from the primary form, but the usual text-books make no such distinction, nor do they lay much stress on the limitation of the process to the dura or to the peridural tissue. Caries of the vertebrae is, naturally, the commonest cause of this condition; then follow suppurative processes near the vertebral canal, as psoas abscess, abscess of the muscles of the back, retropharyngeal abscess, deep sacral bedsores. Gowers believes that most of these cases of so-called secondary pachymeningitis are in reality cases of primary meningitis with secondary abscess formation. The inflammation almost never passes through the dura to the pia-arachnoid. Usually the inflammatory exudate is semipurulent and forms a layer over the outer surface of the dura, especially in the space between the posterior surface of this membrane and the arches of the vertebrae. In those cases which follow caries of the spine the vertical extent of the process is limited to the extent of bone disease. In any case gravity seems to affect the distribution of the exudate, for it rarely rises above the upper cervical region. In acute cases the symptoms are similar to those of the primary form, but not so rapid in development, and they are apt to be somewhat masked by the accompanying disease. Bedsores develop rapidly if the disease lasts long enough.

The only form which affords opportunity for treatment

is that in which there is an accessible focus of inflammation which can be treated surgically. Trephining and free drainage of the vertebral canal is indicated. The general treatment follows that outlined for cerebro-spinal fever.

IV. *Tuberculous Meningitis*.—This form properly occupies a place between acute and chronic meningitis, for it may be acute, subacute, or chronic. It is divided by some authors into primary and secondary, but the primary cases rest on a very infirm base. Councilman has never seen a primary case, and Osler considers such cases very doubtful. A careful search will in almost all cases reveal an old tuberculous focus, if not in the lungs then in lymphatic glands, bone, or even in the middle ear. Jacobäus attributed a case of tuberculous meningitis of the cauda equina to extension from a tuberculous endometritis.

The process is more marked in the cerebral than in the spinal membranes, and the symptoms of spinal meningitis may be masked entirely, yet it is probable that in all cases the spinal meninges are also involved. Lichtheim found tubercle bacilli in the fluid obtained by lumbar puncture in all the cases of tuberculous meningitis examined in his clinic (figures not given); Fürbringer in twenty-seven out of thirty-seven cases. Oppenheim, Heubner, and Leyden and Goldscheider consider extension to the spinal meninges almost invariable. Osler reports a case of pure spinal meningitis (tuberculous). The localization of the process in the membranes at the base of the brain has led to the name "basilar meningitis," the large amount of fluid exudate to the name "acute hydrocephalus" or "water on the brain." It is much more common in children than in adults, but is rare during the first year of life; more common from the second to the fifth years.

The membranes at the base of the brain are cloudy, and covered with an exudate which is serous or gelatinous, or semipurulent, and causes matting of the membranes. There may be numerous tiny white tubercles scattered throughout, or they may be very few and revealed only after a careful search. They tend to form along the small pial arteries, and examination of the choroid plexus may reveal them, or it may be necessary to make a careful dissection of the branches of the middle cerebral arteries, when they will be found along the sheaths of the smaller vessels. Though more fully developed in the basilar region, the tuberculous process spreads to the vertex and to the vertebral canal. The abundant exudate—which is no measure of the extent of the tuberculous process—may cause flattening of the convolutions of the brain and enormous distention of the ventricles. Lichtheim says that the fluid is generally clear, but a delicate veil of fibrin often appears on standing, and is apt to contain in its meshes tubercle bacilli.

The tubercles are miliary, but have a tendency to early caseation, which is found even in the rapid cases—those of nine or ten days. In the slower cases there is an extensive confluence of the tubercles with formation of large caseous masses, in which the bacilli are found in great numbers. Giant cells are not common. Hektoen has described a peculiar tuberculous endarteritis which is not an extension from without, but due to an implantation of bacilli from the blood. The dura may escape entirely, or may show simply congestion. Ophüls describes tubercles of the ependyma either deep, from infection through the lymphatics, or superficial, from infection through the cerebro-spinal fluid.

The prodromal stage is protracted as compared with that of purulent meningitis, and the disease follows well-marked stages. The symptoms of the prodromal stage are headache, listlessness, irritability, constipation, loss of appetite, more or less insomnia. These may pass gradually or suddenly into the stage of irritation: severe headache, vomiting, fever, often convulsions. Headache is apt to be intense and agonizing, requiring powerful sedatives and being sometimes uncontrollable. The temperature rises rather gradually and is not high, 100°-103° F., the pulse increasingly irregular. In this stage the

pupils are contracted, and there are muscular twitchings or spasms. The next stage is marked by a subsidence of the irritative symptoms, the headache is less severe, the head retracted, the patient is dull and stupid, the eyes half closed, the eyeballs moving slowly from side to side, or there may be strabismus, the pupils dilated. Sudden flushes may appear over limited areas and redness follows rubbing or passing the nail quickly over the skin (the tache cérébrale). Convulsions may occur in this stage, which passes over into the stage of paralysis, characterized by a low delirium or coma, with dilated pupils, a weak, rapid pulse, a subnormal temperature, and sometimes paralysis of face or limbs. Death occurs in two to three weeks, sometimes preceded by a sudden rise of temperature.

The type described is that usually seen in childhood. In adults the process is extremely variable. Chantemesse, Boix, and Jaccoud all emphasize the great difference between the form in childhood and that in adult life, Jaccoud, indeed, asserting that the fatal outcome is the only common symptom. Jacobäus, however, explains this partly on the ground that it is the unusual cases only which find their way into the literature. The onset may be very sudden and the disease fatal within a few days. A case of Heubner's—adult—was at work up to thirty hours before death. He was seized with convulsions, delirium, and finally lethal coma. In other cases the disease may apparently begin in the spinal membranes and affect the cerebral secondarily. In a case of Jacobäus', a pulmonary consumptive, the symptoms began in the legs and travelled up. Boix reports a case which simulated tetanus, being ushered in by trismus.

The diagnosis of tuberculous meningitis depends upon the discovery of a tuberculous focus elsewhere in the body, the long prodromal stage, the comparatively low temperature, the marked irregularity and slowness of the pulse, and the more gradual development of the distinctive symptoms of meningitis than occurs in the purulent form. Ophthalmoscopic examination may reveal tubercles of the choroid. The value of Quincke's lumbar puncture has already been emphasized.

The disease is almost invariably fatal. Von Leube reports one recovery. A young phthisical adult had symptoms of tuberculous meningitis, recovered, suffered an exacerbation of the symptoms in the lungs, and succumbed to a second acute attack of meningitis. Examination of the spinal membranes showed evidence of healing tubercles. Reinhold had a case which followed a similar course. In the fluid obtained from a case of supposed epidemic meningitis Freyhan found tubercle bacilli, but the patient recovered. Osler has never seen a case diagnosed as tuberculous recover, nor has he found evidence of past disease at autopsy. Alice Hamilton.

**SPINAL-CORD DISEASES: CERVICAL HYPERTROPHIC PACHYMEINGITIS.**—The first adequate description of this rare disease was given by Charcot in a communication to the Société de Biologie in 1871. Two years later it was made the subject of a thesis by Joffroy, and since that time all writers on nervous diseases have associated the names of these two observers with classical descriptions of this form of meningitis.

Pathologically the disease is characterized by a chronic inflammation beginning on the inner aspect of the dura, and resulting in an exuberant stratiform overgrowth of fibrous tissue. As a result the dura may attain to a thickness five to ten times greater than the normal. The spinal roots traversing the thickened meninges are at first irritated and finally more or less completely strangled by the fibrous overgrowth. Later on, the cord itself shares in the morbid process, either by mechanical compression or by actual invasion, in the latter case the inflammation creeping in along the pial septa and blood-vessels. The ultimate result is a welding together of membranes, roots, and cord in a dense, stratified mass of fibrous tissue which may undergo partial ossification. Vacuolation of the cord has been said to occur as an end result in certain