Original Articles.

TUMOR OF THE SPINAL CORD LEADING TO DESTRUCTION OF THE LUMBAR REGION, HYDROCEPHALUS, DOUBLE OPTIC NEURITIS, AND PAINLESS LABOR. *

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THE following case is reported in detail because of its exceptional character and extreme interest from the diagnostic standpoint and also because it revealed a unique pathological condition as a cause for the imperfectly understood symptoms observed during life. It is rare that so great a diversity of manifestations may be explained by a single lesion.

The patient, a woman twenty-four years old, married, noticed the first symptom of the disease, from which she later died, Sept. 25, 1905. She was at the time pregnant, but had hitherto not suffered more than the usual discomfort. On Sept. 25, during the night, while traveling in a sleeping car, she was suddenly seized with pain radiating down both legs. The next day the pain and discomfort continued and on the whole increased in severity. During the following month, October, she had constant and excruciating pain. During this time she was unable to lie in bed and slept propped with pillows, in a semi-erect position. Treatment by violet rays did not result in benefit. In spite of her discomfort she slept from four to five hours during the night, although often waked by pain. Her mind was perfectly clear. The first week in November there was apparent improvement, although she was never wholly free from pain. In spite of a specially selected carriage driving caused pain. At this time the condition was diagnosed as neuritis. On Nov. 24, she was able to walk from a carriage to the train in New York and had a relatively comfortable trip to Boston. She was seen in Boston by Dr. J. G. Mumford. She was then suffering from extremely severe pain in the legs, coming on in attacks which lasted several hours. There was also complaint of pain in the back. In consideration of the advanced stage of pregnancy and the pain common to women in this condition, it seemed reasonable to suppose that many of her symptoms might be referred to relaxation of the sacro-iliac ligaments. Dr. J. E. Goldthwait, who was called by Dr. Mumford in consultation, confirmed this opinion, and on Dec. 5, etherized the patient and applied a plaster jacket, after having reduced a subluxation of the joint. This was followed by a considerable temporary relief from pain, and the patient was able to lie upon her back, which she had not done for several weeks. This jacket was not well borne, however, and for a time immobilization was obtained by strapping.

On Dec. 7, there was complaint of pain and stiffness of the legs, pain in the region of the bladder, and pressure in the rectum. The patient was extremely restless and much constipated, but obtained a fair amount of sleep. During the days immediately following there was much pain in the legs and back and a constant desire to sit up on account of the greater comfort while in that position. At times the pain in the back and legs would recur immediately on lying down. The urine was passed freely, but was under control. The restlessness evidently induced by pain was constant and distressing, necessitating very frequent

changes of position, both in bed and out. At times the pain seemed to become unbearable, but frequently was alleviated by drugs other than morphine. Toward the middle of December, there was complaint of soreness in hips, legs and knees. She found relief in walking; micturition was frequent, but in spite of this fact she complained that the bladder "felt bursting." On Dec. 22, there was for the first time some difficulty in passing urine with continuance of the complaint of pain in the bladder, at times described as intense. Catheterization relieved this symptom for the time being and large amounts of urine were passed when the catheter was not used, but only after efforts lasting for an hour or more. At about this time she became irrational at night. Excessive pain in the back and legs continued, and the legs and feet began to grow weak. On Dec. 24, when out of bed, she was practically helpless, and could not support herself properly when standing. She was, however, still able to pass urine although with much difficulty. On Dec. 25, control of the feet and legs was practically lost, and there was complaint of numbness of the legs.

On Dec. 26, Dr. J. G. Mumford called me in consultation. In addition to the facts already noted, it was found that there had been definite hallucinations both of sight and hearing, and occasional disorientation both as to time and place. She had at no time been depressed, but on the contrary was rather elated. Many of her remarks concerned events which had not occurred, and there was considerable mental confusion combined with an apparently clear recognition on her part of her mental failings, together with considerable sensitiveness when they were pointed out to her. There had been no elevation of temperature at any time, so far as known, but the temperature had not been taken with absolute regularity. Physical examination on Dec. 26 showed for the time being a somewhat flighty mental state, but absolutely no further disturbance mentally. All questions were answered with absolute clearness. Examination of the legs objectively showed that pain and contact were felt and correctly interpreted, although blunted over certain areas below the knee. Temperature was correctly recognized over both legs wherever tested. The muscular sensibility of the toes was unimpaired, but the soles were not ticklish. The motion of the toes and ankles was preserved and carried out with a fair degree of strength. Both flexion and extension of the knees were, however, very much affected, and, in fact, very little movement was possible. The knee jerks were absent in spite of reinforcement. There was no plantar reflex whatever, no clonus, no Achilles reflex. The paralysis was flaccid. Further physical examination was entirely negative as regards signs of organic disease. There was no definite complaint of the head or upper part of the body, and beyond the mental disturbance already alluded to, there was nothing whatever in the condition of the pupils¹ or otherwise to call attention to disturbance elsewhere than in the lower portion of the spinal cord. The headache, of which complaint was made, was somewhat vague in character, and at this time wholly subordinate to the more intense pain of the lower back and legs. The following day the condition was essentially unchanged. There was, however, much mental confusion regarding time, persons and events. For example, she did not realize that her husband had gone to New York, although well aware of the fact. During the following days there was some improvement in regard to the mental state. She was much clearer, and seldom made mistakes of identity. There was

* Reported at the meeting of the American Neurological Association, Jan. 4, 1906.

¹ The pupils later were widely dilated and immobile, as the subsequent optic neuritis increased to blindness. The fundus when first examined was normal.

an increase of disturbance in the legs. Sensibility was more impaired and the disturbance extended up, involving the thighs. The sense of position of the legs was lost. The bowels were excessively constipated and there was retention of urine with occasional dribbling. On Jan. 11, the urinary incontinence was complete, and the patient had no knowledge whatever of the passage of urine. There was absolute loss of power in the legs and thighs. Sensation was completely lost to all forms of stimulation in the legs. At the upper part of the thigh there was a slight preservation of the pain sense. Slightly higher in the gluteal region and to a point about midway between the pubes and umbilicus there was marked hyperesthesia.

FIG. 1. Areas of anesthesia and hyperesthesia, Jan. 11, 1906. A, Hyperesthetic zone. B, Anesthesia almost complete. C, Complete anesthesia. Disorders of sensation occurring later in body and upper extremities not charted. (See text.)

During the development of these signs of organic disease the patient became more excitable, at times emotional, and occasionally asserted that she had been deceived. On Dec. 29, headache became more conspicuous, together with backache. There was extreme nervousness, restlessness, discomfort and pain. Examination of the urine at this time by Dr. H. F. Hewes was as follows:

Twenty-four hour amount, 2900 cc.; sp. gr. 1004, color pale, reaction acid. Uph.—; Ind.—; B.C., 0; Sulph.—; acetone, 0; urea 23.999 gm.; uric acid, 0.17; chlor. 4.4; phos. a. 0.14; sugar, 0; albumin, slightest possible trace; uric acid to urea 1 to 141. Sediment, occasional hyaline and granular cast with occasional squamous cells and leucocytes. Lead and arsenic both absent.

On Dec. 30, she thought she was in Montreal, but much of the time was entirely rational. The pulse was slightly irregular. On this day there was a consultation of Drs. W. L. Richardson, J. G. Mumford, J. C. Hubbard and E. W. Taylor, at which no definite conclusions were reached. On this day also certain symptoms developed which were regarded as in a measure at least hysterical. On being offered her dinner she asserted that she had already had several and would not eat another. She ate a small amount, however, on

persuasion, but became angry, threw down her fork, screamed loudly and attempted to get out of bed in spite of paralysis of the lower extremities. Up to Jan. 12, symptoms similar to those already described persisted and on the whole increased in severity. Stiffness of the neck was added to the other signs, associated with the greatest sensitiveness on moving the head in any direction. Absolute paralysis of motion and sensation of the legs and of the sphincters persisted. The headache became severe and all the pain, excepting that in the legs, which naturally no longer existed, increased. During this entire period the pregnancy had progressed normally and with no discomfort beyond that naturally incident to the condition.

On Jan. 11, an examination of the fundus oculi by Dr. F. I. Proctor showed a slight and somewhat doubtful beginning optic neuritis with slight lack of balance of the ocular muscles. Several examinations later by Dr. Proctor showed a rapidly increasing swelling of the papillae and an excessive amount of inflammatory exudate. Diminution in vision kept pace with the neuritis and sight was finally completely lost.

On Jan. 13, an examination by Dr. J. C. Hubbard, who was in charge of the case, showed definite uterine contractions; although the patient was conscious of these contractions she made no complaint of pain beyond a certain amount of abdominal discomfort. The membranes had ruptured during the night. About three hours later the head was on the perineum, the labor having been accomplished absolutely without pain. The abdominal muscles apparently took no part in the process, although the uterine contractions up to this time had been adequate, though lacking in force. There was, however, no evidence that further progress would be made. Low forceps were applied and a healthy girl baby delivered without difficulty. The perineum was torn and was at once sewed up without the slightest evidence of pain. There was no post-partum hemorrhage and the uterus contracted in perfectly normal fashion and without further incident. The entire labor had been accomplished without pain, and, in fact, the birth of the baby was merely an incident in the day, insignificant in comparison with the pain and distress caused by the underlying disease. No anesthetic was at any time used and the patient was practically unconscious of the process of delivery, although there was some complaint when the placenta was expressed by a hand on the abdomen. Dr. Hubbard calls attention to the following points of interest in the labor: (1) Its painless character. (2) The absence of any instinctive use of the auxiliary muscles during the second stage. (3) The satisfactorily firm contractions of the uterus after the labor. The possibility of a severe post-partum hemorrhage had been considered, due to an interference with the proper nerve supply to the uterus.

The patient remained under Dr. Hubbard's care during an uneventful convalescence from the labor. She did not nurse the baby, and there were no complications whatever of an obstetrical sort. In other respects the condition remained essentially the same, except that toward the end of January there was some nausea associated with headache and at times rather free vomiting. The pain was localized in the middle of the back and occasionally extended up into the neck. There was complaint of a feeling of general numbness and pain, particularly in the left eye, with ringing sounds in the right ear. An examination of the ear by Dr. E. A. Crockett found no local cause for this latter symptom. Jan. 26, there was a further consultation by Drs. W. L. Richardson, J. C. Hubbard and E. W. Taylor. The patient had again become very disturbed, continually twitching and working her

hands in a more or less purposive way. Ringing in the ears continued and there was complaint of prickling sensations in the arms. The mental state was, however, such that no adequate or systematic examination of the objective sensory disorders in the upper part of the body and arms was attempted. The symptoms in general were of an irritative character. There was at no time paralysis of the upper extremities. During the latter part of January an attempt to express herself could not be understood. She was emotional at intervals, refused her medicine, and was apparently much distressed in mind, muttering constantly and incoherently. She also refused food, made few requests, and lay much of the time, when not moving her hands, in an apathetic state with her eyes closed. At this time she was disoriented, and also on one occasion refused tea, saying it was rotten and filled with drugs. In spite of these occasional lapses, however, her appetite remained remarkably good, and, in fact, continued so up to the very end of her illness. She was interested in the baby for some weeks after her birth, and frequently asked to have her in the room. This interest she later entirely lost.

Early in February, Dr. J. C. Hubbard retired from the case with the patient recovered from the effects of labor. An examination on Feb. 6, showed no Faradic reaction whatever in any of the muscles of the legs to very strong currents. Complete paralysis of sensation and motion remained. By means of regular catheterization at short intervals the urinary conditions were somewhat improved, although there was absolutely no control. The condition of the bowels also improved very considerably, and, although requiring strong cathartics and occasional enemas, the previous impaction was in great measure overcome. The attempt to use a wheel chair did not meet with success, although frequent efforts were made. On the whole the patient was now much more comfortable lying flat than in an upright or semi-upright position. A bed rest was used temporarily with satisfaction, but the patient never sat up for any length of time without complaint of much discomfort and an expressed desire to return to bed.

Examination of the eye grounds by Dr. Proctor early in February showed much swelling of the left optic disc and considerable inflammation of the right. The sight of the left eye was practically abolished and of the right much blurred. She could count fingers but was wholly unable to read typewriting in any position or with any light. The visual fields roughly tested were apparently normal so far as the deficient sight permitted a determination. An examination of the urine by Dr. Wilder Tileston from a catheter specimen showed pale color, acid reaction, specific gravity 1010, cloudy, slightest possible trace of albumin, no sugar, and normal chlorides. The sediment showed no casts and nothing of significance beyond a moderate amount of pus. An examination later by Dr. Tileston for arsenic showed a wholly insignificant trace.

During the first part of February, except for occasional lapses, the patient was mentally clear nearly all the time, but complained constantly of pain in various parts of the body and general discomfort. On the whole, however, she was cheerful, and extremely courageous, though at times naturally discouraged. Dr. Morton Prince saw the patient on several occasions at about this time. He was unable to explain the curious and changing mental condition which he was inclined to think might be analogous to certain hysterical states, or possibly to an intoxication of some unknown sort. He also suggested the possibility of tumor, but owing to the unexplained combination of definite signs of transverse lesion of the cord in its lower portion,

together with marked cerebral symptoms, notably optic neuritis, this idea was not seriously entertained.

During a night in the latter part of February the patient became suddenly apprehensive and assured the nurse that an attack of some sort was imminent. Soon thereafter she became totally incoherent in speech, possibly beginning or ending a sentence with a definite word, but using absolutely unintelligible syllables between. This incoherent muttering continued almost constantly for some hours. This was followed by vivid hallucinations of sight and occasionally of hearing with constant movement of the arms and fingers as of tying and untying string. During the remainder of her life she at no time completely recovered from the condition which was ushered in by the foregoing sudden mental change. She became increasingly apathetic and indifferent to her pain, but at no time was she totally unconscious, or presumably ignorant of her surroundings. It was evident that her weakness was increasing and that nothing but a fatal outlook was to be looked for, although previously hope had been entertained that the underlying process might be of the nature of a myelitis and self-limited.

Early in March, Dr. F. C. Shattuck was called in consultation and again later. He found absolutely no abnormality of the chest or abdominal organs, and, like those who had previously seen her, was at a loss as to a definite diagnosis. A blood examination by Dr. John B. Hawes at this time was as follows: Hgb. 80%; reds 6,232,000; whites 10,500. Stained specimen showed no achromia or other abnormality. No blasts or plasmodia seen. Diff. count of 500 whites showed: Polynuclear, 70.8%; lymphocytes, 26.6%; eosinophiles, 2.6%.

At about this time a very slight paresis of the left facial nerve was observed, together with slight disturbance in the movements of the left eye, both externally and internally. These disturbances, however, did not increase, but on the other hand the facial paralysis distinctly improved later. She was at this time probably totally blind, but made small complaint either of this or of other symptoms. Owing no doubt to the increase of the cerebral symptoms and the blunting of sensibility dependent thereon, her suffering was very decidedly less than during the previous months, although it was evident from time to time that pain of the back, neck and head persisted. Weakness increased rapidly, and although food was fairly well taken up to within a week of her death, her strength failed to such an extent that all movement was impossible and even swallowing became difficult and a painful effort. The urine became scanty in amount, of high specific gravity; the pulse for some weeks was between 110 and 140, and the respiration increased to 36 to 40 toward the end. She died quietly March 25, without suffering, but apparently conscious up to a short time before.

AUTOPSY.

A complete examination was made by Dr. S. B. Wolbach, March 25, three and a half hours post-mortem, the notes of which follow:

Body well developed, but poorly nourished. No rigor. Slight lividity of the dependent parts. No edema. Pupils equal, 0.5 cm. There is a scar in the left axilla, several linear scars over the right tendo-Achillis. The feet are extended.

Peritoneal cavity.—Abdominal fat 1.5 cm. thick, deep yellow in color, loose in texture. No retroperitoneal fat. The peritoneal surfaces are everywhere normal. No free liquid; no adhesions. There is a small calcified node, 0.5 cm. in diameter, in the superior ileo-cecal angle. Several mesenteric nodes contain minute, calcified nodules. The diaphragm reaches to

the fourth space left, fourth rib right. The appendix is normal, about 8 cm. long, directed upwards and inwards. The proximal half is retroperitoneal, the distal half is free with a mesentery.

Pleural cavities. — Normal.

Pericardial cavity. — Normal.

Heart. — Normal in size, weight 250 gm. There is very little epicardial fat. The myocardium is firm, dark red, walls are rather thick. Valves and endocardium are normal. Coronary arteries are normal.

Lungs. — Both lungs are pale red, soft, dry, except along posterior borders, where they are darker in color, wet and injected.

Spleen. — Weight, 110 gm. Normal in size. Capsule smooth. Color, bluish red. Consistency, firm. On section normal structures are visible.

Liver. — Weight, 1300 gms. Dark red in color. Capsule smooth, even. Consistency, normal. On section lobular markings are easily visible by virtue of darker red centers. Gall bladder and ducts normal.

Pancreas. — Normal.

Gastro-Intestinal Tract. — Normal. The transverse and descending colon are filled with nodular masses of dry, dark brown feces.

Kidneys. — Weight, 265 gm. Normal in size. Dark red in color. On section the pyramids are dark red. The cortex is pale, with dark red radial lines. Glomeruli prominent as red dots. The consistency is very firm. Capsule strips easily from a smooth surface. Cortex measures 6-8 mm.

Adrenals. — Normal.

Genitalia. — Normal. Bladder, normal.

Aorta. — The intima has a few bright, yellow linear elevations in the lines of the orifices of the intercostal arteries.

Head. — Scalp normal. Pacchionian granulations are small, but numerous.

Brain. — The convolutions are flattened. Pia is dry, markedly injected. While the brain lies in position, the posterior half bulges slightly, and is firmer on palpation than the anterior half. The vessels at the base are normal. The olfactory grooves are deep, their foramina are large. The dural sinuses at the base are normal. The floor of the middle fossa on the left side near the anterior margin contains several small pits and the dura corresponding presents small, soft, grayish excrescences. The olfactory bulbs are poorly defined and the olfactory tracts terminate in masses of gray matter with irregular surfaces, molded apparently to correspond with the deep, olfactory grooves. The consistency of the brain is slightly plastic. The cortex on section has a bluish tinge. The puncta cruenta are prominent as oozing points. The lateral ventricles are markedly dilated and contain about 80 cc. of clear, colorless liquid. The ependyma is normal. Nothing abnormal found on section of the hemispheres, basal ganglia, pons, medulla and cerebellum.

Cord. — The cord completely fills the spinal canal and the exposed dura presents many irregularities. In the region of the cauda equina the canal is packed with a soft, inter-dural mass, which after removal of the cord, presents as a spindle-shaped mass, matting together the filaments of the cauda equina and extending upwards surrounding the whole lumbar enlargement. The whole dorsum of the cord as far as the middle of the cervical enlargement is covered with an irregular, knobbed, sub-pial growth. In the lumbar region there is a fairly uniform layer, 2-5 mm. thick, surrounding the cord, invading it and filling the spinal canal below. In this region the mass is composed of yellowish, rather firm tissue in places soft and necrotic, with occasional small foci suggesting hemorrhage.

In the upper thoracic and cervical cord the dorsal surface alone seems to be involved. In the lower thoracic cord there is a fairly uniform layer of grayish, translucent, rather firm, and elastic tissue with many rounded knob-like projections. Higher up the layer is thinner, in places not demonstrable, but there are mounds of similar tissue 2-5 mm. in diameter, closely placed as far up as the middle of the cervical enlargement. Here there is again a sheath 2-3 mm. thick on the dorsal surface, and above this a few small nodules, extending about to the upper third of the cervical enlargement, higher on the left than on the right side.

FIG. 2. Cross sections of cord from lumbar to upper cervical region, showing extent and position of tumor. 8. Lumbar region, practically complete destruction. In upper sections note dorsal sub-pial position of the growth. In upper sections note dorsal sub-pial position of the growth. The secondary degenerations, mainly of the dorsal tracts, are explained by the partial destruction of the dorsal nerve roots, portions of the dorsal tracts, and to a much less degree of the dorsal gray leading to slight degeneration in Gowers's and direct cerebellar tracts. (Accurate tracings, Edinger drawing apparatus.)

In no place is the pia penetrated. The sub-pial vessels are injected, tortuous, in places pushed up, in places surrounded by the growth. Section of the lower lumbar cord shows an apparent continuity between the growth and the gray matter. The cord is everywhere distorted and soft. In the lumbar region the cord is markedly flattened and in places no margin can be made out between the tumor mass and the cord. In the dorsal and cervical regions the cord is sharply demarcated from the surrounding growth. Several dorsal ganglia removed from each of the cervical, dorsal and lumbar regions are apparently normal.

FIG. 3. Lumbar region No. 8 of Fig. 2, $\times 6.1$. Practical complete destruction of the cord by the tumor. (Photograph by W. C. Greene.)

FIG. 5. Mid-thoracic region, No. 5 of Fig. 2, $\times 6.1$. Dorsal position of main tumor; the subpial location is well shown, also the manner of invasion of the cord. (Photograph by W. C. Greene.)

FIG. 4. Lower thoracic region No. 7 of Fig. 2, $\times 6.1$. Dorsal position of tumor; slight invasion of the ventral surface. Disintegration of the substance of the cord. (Photograph by W. C. Greene.)

FIG. 6. Edge of tumor, $\times 98$. Sarcoma made up of small round cells fairly uniform in size. No evidence whatever of neuroglia fibrils. (Photograph by W. C. Greene.)

ANATOMICAL DIAGNOSIS.

Sarcoma of the spinal cord. Internal hydrocephalus (acquired). Congestion of liver and kidneys. Retention of feces.

MICROSCOPIC EXAMINATION.²

Histologically the new growth consists of relatively small, for the most part round, cells, with a small amount of protoplasm. The cells are in general uniform in size and arranged indefinitely as regards blood vessels and stroma. (Fig. 6.) In places the tumor has evidently followed the course of least resistance along the walls of the blood vessels, but in general the relation to blood vessels is entirely indefinite and the cells are no more numerous in their immediate neighborhood than elsewhere. Most careful study by means of several neuroglia stains, especially phosphotungstic acid hematoxylin, showed no evidence whatever of fibrils. The blood vessels are extremely numerous throughout the tumor and in certain places there is evidence of free hemorrhage. So far as can be determined at the late stage at which it was possible to study the tumor, the new growth began in the membranes external to the cord, presumably in the region of the cauda equina, and even in its developed state lay between the pia and cord, infiltrating and destroying the cord only at certain levels later to be described. In general the invasion of the cord is sharply marked and a fairly sharply defined line separates the pathological from the normal tissue. It is evident that the external surface of the cord afforded a barrier to the growth of the tumor inwards. Except in the lower portion of the cord the tumor lay almost entirely on the dorsal side and between the pia, which is lifted by the tumor from the cord, and the cord itself. The subdural space was in no part affected except possibly at lower levels where the destruction was practically complete of all the nervous structures.

Appearance at various levels. — The sacral and lumbar cord is practically entirely destroyed by the invasion of the tumor. At these levels it is impossible to distinguish the outlines of the cord or the distinction between the gray and white matter. Weigert myelin sheath stains show in these levels a complete disintegration of myelin, and the nerve roots, both dorsal and ventral, are likewise indistinguishable in the tumor mass. (Fig. 3) At the upper levels of the lumbar enlargement and the lower part of the thoracic region, the cord, although very much distorted and disintegrated, is not completely destroyed. (Fig. 4.) The mass of the tumor at this level is localized on the dorsal portion of the cord, involving and destroying the dorsal nerve roots and sparing the ventral nerve roots. The cord itself is also to a certain degree invaded by the new growth. The same condition persists throughout the thoracic region (Fig. 5), the tumor, however, decreasing somewhat in extent, but always sharply localized dorsally and wholly within the pia. The invasion of the cord varies at different levels, but the ventral horns are nowhere involved above the lumbar enlargement. In the cervical region the tumor gradually disappears, extending, however, well into the enlargement and involving, as below, the dorsal nerve roots. The tumor also appears in very slight degree at certain levels on the ventral surface of the cord, but not sufficiently to involve at any level above the lower thoracic region the ventral nerve roots. Secondary degeneration of the dorsal tracts, and also in lesser degree of the direct cerebellar and Gowers's tracts, occurs throughout the thoracic and cervical

regions. The fact that the columns of Burdach in the cervical region are not deeply degenerated naturally indicates that the thoracic nerve roots were not completely destroyed in their passage through the tumor.

The oblongata is normal and the brain also shows no abnormality beyond the high degree of hydrocephalus. Most careful examination shows that the tumor is limited to the spinal cord and in all probability is a continuous growth from below upwards, showing no metastasis even in the cord itself. Owing to the hydrocephalus the optic chiasm is very markedly compressed. Microscopic examination, however, shows no evidence of edema or other pathological change in spite of the high degree of choked disk observed during life. Examination of other internal organs shows no significant abnormality except very slight evidence of previous but healed tuberculosis.

SUMMARY. The essential features of the foregoing case are as follows:

A young, pregnant woman was suddenly seized with radiating pains down both legs, in September. The pain increased, and walking became difficult on account of the pain. The urine was at first under control. Later, the pain extended to the bladder and rectal regions, and in the latter part of December, difficulty in micturition supervened, necessitating the occasional use of the catheter. Beginning mental disorder appeared at this time; pain extended into the back; beginning paralysis of the legs, standing alone impossible; urine passed only with extreme difficulty; sensory disorders in the legs developed; loss of power in the legs rapidly supervened, together with disappearance of the reflexes. Increase of mental confusion, disorientation as to time and place; extreme constipation, and complete urinary incontinence. Thereafter, headache, much restlessness and discomfort, stiffness of the neck, and sensitiveness on moving the head; increasing headache, beginning optic neuritis, going on later to blindness. In the middle of January a painless labor, giving birth to a healthy child. Prickling sensation in the arms, but without paralysis. In February, persistence of complete transverse lesion of the cord, with no Faradic response in the muscles of the legs. Very marked mental disturbance, with final loss of the power of speech, and increasing apathy. Death six months from the onset of the first pain.

POST-MORTEM. Extensive tumor of the spinal cord, destructive in the lumbar region, associated with internal hydrocephalus.

DIAGNOSIS.

The signs and symptoms observed during life are evidently completely explained by the post-mortem findings.

PAIN. A predominant feature of this case from its beginning to its end was pain, the significance of which was not at any time completely appreciated. The original assumption in the early part of the disease was that the pain was due to a peripheral nerve affection which was regarded as a neuritis. A later assumption was that the pain, confined as it was largely to the legs in the sciatic distribution, was due to the loosening of the sacro-iliac joint, in part a consequence of the ad-

² I am indebted to Dr. S. B. Wobach for assistance in making histological preparations and in interpreting the appearances, as well as for the gross pathological examination.

vanced pregnancy. Investigation showed that there was an actual displacement of the bones, and their restoration to a proper position gave rise to an amelioration of the symptoms which, however, did not persist. The pain later redeveloped in a severe form, as before the operation on the joint. This idea, therefore, although no doubt explanatory of a part of the discomfort, did not account for the persistent and distressing pain. The third supposition, which was erroneously entertained by many of the physicians who saw her, was that the pain in great measure was due to the somewhat nervous condition in which the patient was supposed to be, partly as a consequence of her pregnancy, and partly as a temperamental peculiarity in a person who had in her previous life not been the victim of pain. Under this supposition it was supposed that the pain was less severe in character than appeared from the statements made regarding it by the patient. In the light of the outcome this theory was proved to be wholly incorrect, but there was much reason for entertaining it during the illness. It was, for example, repeatedly observed that relatively small doses of the less powerful drugs apparently frequently produced an amelioration of the pain. Excepting on one or two occasions morphine was at no time given. It was also supposed that the pressure of the pregnant uterus possibly might conduce to pain in the legs through actual pressure. The correct interpretation of the pain as due to the tumor was at no time made, although Dr. Prince, in consultation, suggested the possibility of new growth. The extension of the pain upward, the stiffness of the neck, with extreme discomfort on moving the head, and the varied descriptions of abnormal sensations which the patient gave did not throw light during life on the cause of the pain. Had the discomfort remained localized in one part of the body the confusion would not have been so great; its widespread distribution somewhat naturally obscured its cause.

The findings at the autopsy completely explained the pain. The tumor undoubtedly originated in the nerve roots of the cauda equina. The first symptoms were irritative in character, radiating pains down the legs. Later, as the tumor extended and destroyed the lumbar region, the pain in the legs gave place to a complete paralysis, both of sensation and motion, naturally with a cessation of pain in that region. As the disease progressed upward, involving the dorsal nerve roots practically throughout the entire extent of the cord, pain naturally developed at the various levels of the spinal segments, and finally involved the neck and arms to a certain degree. The head pain was due to the hydrocephalus, a consequence of the tumor, and misleading in its significance.

MYELITIS. In addition to the confusion resulting from the interpretation of the pain, the relatively sudden onset within three weeks of a complete transverse lesion of the cord in the lumbar region still further complicated the situation. In spite of the fact that there was no evidence of

a rise of temperature during this period, or immediately preceding it, the character of the onset, and the completeness of the resulting lesion led to the supposition that a softening of the cord had taken place, presumably of an inflammatory sort, producing a lesion which might justly be termed a transverse myelitis. The signs of transverse lesion were almost complete. There was almost absolute sensory and motor loss from about the level of the pubes down, with an area of hyperesthesia immediately above this level. It was supposed not unnaturally that a destructive lesion of the cord had occurred, which would remain limited to that area; and the opinion was expressed that this lesion had no direct causative relation with the pregnancy, but was rather to be considered as a coincidence. This subsequent developments proved to be the fact.

The etiology of this condition was, in the minds of those who saw the patient, absolutely in doubt. To use a popular, but not altogether exact, term, it was regarded as probably an intoxication or infection localizing its destructive effects at a certain level of the cord, but also influencing higher areas in the nervous system, as shown particularly by the mental disturbance which was already conspicuous at this time. This idea was further re-enforced as time went on by the appearance of an optic neuritis and increasing mental disturbance for which no adequate cause could be found. In 1899, Bielschowsky³ reported in the form of a monograph four cases with autopsies, of myelitis associated with optic neuritis. In these cases disseminated lesions of the cord and of the optic nerves were disclosed post-mortem, due it was supposed to a common cause.

The combination of mental symptoms, considerable though not excessive headache and optic neuritis, together with the symptoms of a transverse lesion of the cord somewhat naturally diverted attention from the correct diagnosis. As the case progressed, however, the increasing failure of strength was difficult to interpret, together with the pain which, although no longer appearing in the legs, was a constant source of complaint through the back, neck and, in less degree, in the arms.

Here again, the autopsy provided a complete explanation of the clinical symptoms. The transverse lesion of the cord was due to the somewhat sudden invasion by the tumor of the lumbar region. The optic neuritis was unquestionably due to the hydrocephalus which in its turn resulted from the complete occlusion of the vertebral canal by the tumor throughout practically its entire length. The mental symptoms also no doubt find their explanation in the disturbance occasioned by the hydrocephalus. The clinical interpretation was defective, but it is altogether questionable whether the evidence during life as demonstrated post-mortem would have justified the assumption of a single tumor as the cause of the cerebral as well as the spinal symptoms.

³ Bielschowsky: *Myelitis und Sehnervenerntzündung*. Berlin. 1892. S. Karger. Pp. 92. Ref. *Neurologisches Ctbl.* 1901, vol. xx, 457. Clinical course of cases. Schuster and K. Mendel, *idem.*, 1899, pp. 1088-1093.

That the motor power in the arms was at no time affected is explained by the fact that the tumor in its course upward through the spinal canal was confined almost exclusively to the dorsal portion of the cord, never, in fact, invading the ventral portion in the upper thoracic and cervical regions to an extent sufficient to produce definite motor disturbance of the arms.

The clinical course of the case therefore finds complete explanation in the pathological findings. The initial pain, the succeeding apparent myelitis, the ascending disturbances in the body and arms of a sensory sort, and, finally, the altogether puzzling involvement of the brain in the process, together with a degree of optic neuritis which led within a few months to practically complete blindness were due to a single widely extended spinal tumor, destructive of the cord in the lumbar region, external to the cord in the thoracic and cervical regions, and obliterating practically the entire spinal canal.

REMARKS.

Several matters in relation to this altogether extraordinary case demand further comment.

THE PATHOLOGICAL CONDITION. A tumor involving so great an area of the spinal cord and canal is exceedingly unusual.⁴ Except in cases of general metastasis, the location of a spinal tumor is, in the great majority of cases, somewhat sharply circumscribed and therefore in a measure amenable to surgical interference. In this case the growth of the tumor was evidently continuous from below upward, although at many points the growth assumed a nodular form, which superficially gave the appearance of discrete tumors. There were no metastases, and the oblongata and brain in general were uninvolved by the tumor. The location between the pia and the cord, except at the lower levels, was noteworthy, and also the relatively slight tendency to actually invade the cord except where the mechanical conditions of rapid growth in the lumbar region apparently necessitated such invasion. The histological character of the tumor was somewhat unexpected, namely, a small-celled sarcoma. Evidence of glia cells was wholly lacking. In the light of the clinical history, the tumor undoubtedly originated in the sacral nerve roots, which could hardly have been the case had it been a gliomatous tumor, except through some malformation of tissues, which the autopsy did not reveal. The points of chief interest regarding the tumor are: its histological character; its extent; its method of growth, and the diversified symptoms it was capable of producing. The etiology of the tumor is wholly obscure.

THE PAINLESS LABOR. The birth of a baby at term was, so far as the patient was concerned, a trivial incident in the course of her illness. The labor was absolutely painless, due naturally to the complete destruction of the lumbar cord. The only indication of the beginning of the prog-

ress of the labor, as expressed by the patient, was that she had some "pain in her stomach," to which, however, she gave little attention. The beginning of labor was only determined by the perfectly definite and apparently normal contractions of the uterus as felt through the abdominal wall. The baby's head reached the perineum without incident, and without conscious labor pains. The uterus then ceased to perform its function, and extraction by forceps was necessitated. This was easily accomplished, and a perineal tear sewn up absolutely without pain to the patient. After labor the uterus contracted normally, and there was no hemorrhage, which naturally had been feared. The convalescence was so overshadowed by the underlying disease that it made little impression either upon the patient or upon the attendants. Naturally the same precautions were taken as in an ordinary labor. The perineal tear healed entirely without complications in spite of the complete anesthesia of the part, and the urinary incontinence. The development of the baby was entirely uneventful.

OCCURRENCE OF OPTIC NEURITIS IN TUMORS OF THE SPINAL CORD. In spite of the fact that optic neuritis has occasionally been described in cases of tumor of the spinal cord, this event is so unusual as to justify a serious doubt regarding diagnosis if it occurs. This is particularly true in tumors involving the lower portion of the cord. In such cases, so far as we are aware, optic neuritis has never occurred, nor would it have occurred presumably in this case had the tumor not also extended into the cervical region, and thereby made possible the condition which led secondarily to the neuritis. In our case the explanation of the neuritis is evident: it was due to hydrocephalus which in turn was occasioned by the practical occlusion of the spinal canal by the tumor. This led to a blocking back of the cerebrospinal fluid normally finding egress from the brain into the subdural space of the cord. It is difficult to conceive that such a mechanical cause for optic neuritis could arise from a tumor limited to the lumbar region. Had we suspected an extension of the tumor upward, as proved to be the case, a possible explanation of the optic neuritis might have been reached before death. In the absence of such knowledge the supposition of a common inflammatory process producing at the same time a destructive lesion of the spinal cord and an optic neuritis was the more justified hypothesis.

Kernhensteiner⁵ has recently reported a case of optic neuritis and myelitis, and gives as an explanation a common toxic cause, after the manner of tabes. In 1901, James Taylor and Collier⁶ made a careful study of the occurrence of optic neuritis in various lesions of the spinal cord. In this article they report twelve personal cases, but only one with autopsy, cite the cases in literature, and analyze a large number of local lesions observed at the National Hospital between the

⁴ Nonne has reported a somewhat similar case also with optic neuritis. Ueber einen Fall von intramedullärem ascendirendem Sarcom, sowie drei Fälle von Zerstörung des Halsmarks. Arch. für Psychiat., 1900, vol. xxxiii, 393-430.

⁵ Kernhensteiner: Ueber Neuromyelitis optica. Münch. med. Wochenschr., 1906, vol. liii, 802. References to literature.

⁶ Taylor and Collier: The occurrence of optic neuritis in lesions of the spinal cord, etc. Brain, 1901, vol. xxiv, 532.

years 1892 and 1900. In their own cases they found optic neuritis associated with tumor in two, and possibly three, cases, all localized in the cervical region, judging from the symptoms. There were five and possibly six cases of optic neuritis associated with myelitis, again in all cases involving the cervical and upper dorsal portion of the cord. From this analysis it appears that myelitis is a far commoner cause of optic neuritis than tumor. The relation of neuritis to lesions of the spinal cord, according to these authors, depends, first, upon the position of the lesion, second, upon some peculiarity in the nature of the disturbance of the function of the spinal cord produced by the lesion, which, although in some cases extensive, has always been partial. Beyond this the authors advance no definite theory, but call attention to the fact that even in the cervical lesions optic neuritis is exceedingly rare. These writers hold that the theory of separate inflammatory foci is not tenable, particularly in cases of spinal tumor. In a further series of cases to which Taylor and Collier refer, numbering 154, and including myelitis, new growth, hematomyelia, fracture dislocation, pachymeningitis, and spinal caries, the optic discs were normal in 135 cases, making neuritis present in but 19. Of these 18 were lesions affecting the cervical enlargement, one, the thoracic region, and in no case did lesions of the lumbo-sacral cord produce neuritis. There were but three cases of new growth; two in the cervical region, and one in the upper thoracic, but only one of these was verified by autopsy. Myelitis was associated with neuritis in eight cases, and these also were nearly all cervical. The lowest myelitic focus was at the sixth dorsal vertebra.

From these statistics it is clear that optic neuritis associated with myelitis is very infrequent but, particularly in view of the Bielschowsky cases,⁷ is by no means unknown. But even in these the higher lesions of the cord are much more frequently associated with neuritis than the lower. The assumption, therefore, in our case, in view of the clinical symptoms, was in a measure justified that we were dealing with an inflammatory process rather than with a new growth. In this connection a case recently reported by Weisenburg and Thorington of syringomyelia with double optic neuritis is of interest. These writers refer to two other cases in the literature, and give as possible causes: first, an intracranial growth, and, secondly, internal hydrocephalus, the latter of which they regard as the more probable. In these cases undoubtedly the mechanism is exactly similar to that in our case, namely, an occlusion of the spinal canal in its upper portion by a distorted spinal cord, resulting in hydrocephalus, and consequent optic neuritis.

The condition is so unusual a one, and particularly in our case so completely eluded diagnosis during life, that it is well worthy of special mention.

ONSET OF PARALYSIS. The relatively sudden onset of paralysis of the lower extremities was

a further source of confusion in the diagnosis. When I first saw the patient she had a beginning, very definite weakness of both legs, together with sphincter disturbances. In the course of a week or ten days this had progressed to a practically complete transverse lesion of the cord. Apart from the other considerations such an onset of paralysis naturally would lead, as it did in this case, to the supposition that a local, presumably inflammatory, condition, or one due to softening from vascular causes, was at the basis of the disturbance. In addition, one would not expect so sudden a loss of power as the result of the invasion of a tumor, although such cases have been described. The completeness of the paralysis is also worthy of special note. The patient had practically no consciousness whatever of the existence of her legs from the time the paralysis became complete up to the time of her death. There was absolute loss of both deep and superficial reflexes, no doubt explained either on the basis of complete destruction of the cord, or, more probably in this instance, by the actual invasion of the reflex arc by the new growth. It was not possible to bring the pregnancy into immediate relation with these symptoms of transverse lesion of the cord. The painless labor which followed shortly after the onset of the transverse lesion of the cord is further evidence of the complete destruction of the spinal cord at that time. The cessation of pain in the legs following the lumbar destruction was, of course, to be expected, but naturally threw no added light upon the nature of the destructive process. It is worthy of passing mention that bed-sores and other trophic disturbances in the legs were absolutely avoided.

LUMBAR PUNCTURE. Lumbar puncture was not done. There was no evidence whatever on the clinical side that a meningitis lay at the bottom of the symptoms, and for various reasons it seemed undesirable, unless there was special indication, to perform even so simple an operation as lumbar puncture for diagnostic purposes. Had such a puncture been made early in the disease it is altogether probable that a dry tap would have resulted, but very probably certain of the tumor cells might have been extracted with the needle, which would have assisted, if not definitely established, the diagnosis. Had this occurred it is possible that surgical interference might have been considered.

THE POSSIBILITY OF OPERATION. When the diagnosis of spinal tumor was definitely established post-mortem, the question naturally arose as to whether it would have been possible at any period of the disease to have operated with success. It must be remembered in considering this question that the patient was well advanced in pregnancy at the time the first irritative symptoms on the part of the sacral nerves appeared, and presumably would have been a poor subject for laminectomy. If, however, in spite of the pregnancy, such a procedure had been undertaken it is altogether improbable that the tumor could have been completely removed. Its growth

⁷ *Loc. cit.*

evidently was extremely rapid, and it was clearly not encapsulated. Shortly after the onset of the first pain the disease involved a large area of the sacral nerves within the spinal canal, and it is highly improbable that a growth of this character could have been reached with sufficient thoroughness to have completely extirpated the disease. Naturally, under all the conditions the indication for operation must have been absolutely plain before any such procedure could with justice have been undertaken. Lumbar puncture might have given the information desired; that is, however, merely a matter of speculation. It is certain that when the tumor had attained to sufficient extent to involve the cord substance itself, which occurred in the latter part of December, operation could not have been undertaken with the slightest hope of permanent relief. The post-mortem examination did not definitely reveal the place of origin of the tumor, and in the absence of exact knowledge bearing upon this point it is unnecessary to speculate further as to the conceivable possibility of operation at any stage of the disease.

INTERPRETATION OF PAIN. Apart from the diagnostic difficulties which this case presented, and their perfectly clear explanation by the autopsy, the matter of the interpretation of the pain is deserving of a few words of final comment. The patient unquestionably suffered extremely from the beginning to the end of her illness. In fact, it is hardly possible to conceive of a condition of affairs more calculated to produce pain of a most excruciating sort, than was found in this case. The various physicians who saw could not fail to recognize the fact that she was suffering constant discomfort, and often pain. They were, however, deceived as to the real extent of this pain, which undoubtedly was very much more severe than was supposed. Morphine was withheld, partly because of the wishes of the family, and partly because those in attendance felt that the pain could be controlled by less radical means. This was a mistake. Morphine should have been administered freely, and much more weight should have been given to the complaints of the patient who bore her suffering with heroism from the beginning to the end of her six months' illness.

THE CONTROL OF SYPHILIS AND VENEREAL DISEASES.*

BY PRINCE A. MORROW, M.D., NEW YORK.

I wish to express my sense of appreciation of the honor of being invited to appear before you this evening. I have accepted the invitation all the more willingly as it affords the opportunity of presenting before this representative body of medical men of Boston the general features of a plan of control which was inaugurated in New York, some eighteen months ago, by the American Society of Sanitary and Moral Prophylaxis, and I do this with the confident hope that a society

* Read before the meeting of the Boston Library and the Suffolk District Medical Society, Dec. 10, 1906.

similar in aims and purposes may be organized in this city.

It has long been recognized that the control of a class of diseases, which, in their genesis and mode of spread, are pre-eminently, social diseases, is the most difficult of all the problems of hygiene. These diseases are not only a grave danger to the public health, but, through their morbid irradiations, constitute a serious menace to the health and productive energy of the family, and thus become a powerful factor in the degeneration and depopulation of the race.

It is hardly necessary to spread before this body of medical men the pathological balance sheet of venereal infection in order to emphasize the importance of the subject for discussion this evening. Lest we forget the enormous debt created by these infections, and which humanity must pay in suffering, disease and death, let us glance for a moment at some of the more salient items in this exhibit. The mere inventory of the morbid conditions, chargeable to syphilis alone, would include entries from every department of pathology. A large number of morbid conditions formerly credited to other pathogenetic factors are now recognized as the product of syphilis.

Syphilis is met with, in some of its forms or manifestations at least, in every branch of practice. It furnishes a large contingent of morbidity in the practice of the neurologist, the gynecologist, the eye, ear, throat and nose specialists, as well as the internist in general medicine. The significance of syphilis as a danger to health and life is not measured by its immediate effects. Acquired syphilis rarely overcomes the citadel of life by direct assault; its rôle is that of the sapper and miner. It undermines the constitution, weakening its organic defenses and inaugurating changes which render it an easy prey to other forces of disease. It is especially in its late or terminal stages that its worst effects are manifest, in lesions which seriously compromise the integrity of organs essential to life.

In the sphere of the nervous system alone we may place to the debit side of syphilis 90% of locomotor ataxia, more than 75% of ocular paralyses, a large but indeterminate proportion of general paralysis, paraplegia and hemiplegia; 80% of all cases of paresis give a syphilitic history, — all affections of a serious nature and, for the most part, incurable.

The pathologic liabilities of gonococcus infections are scarcely less formidable. Less than a generation ago it was not suspected by the medical profession that in what was regarded as a trivial local disease of the urethra there lurked a germ possessed of such pathogenetic possibilities as we now ascribe to the coccus of Neisser, — a germ which is susceptible of being taken up into the circulation, causing serious articular and often fatal systemic complications; an infection, which, in respect to the character and sum total of its dangers constitutes a greater social plague, perhaps, than syphilis.

We are indebted to gynecologists for statistical