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INTRAMEDULLARY TUMOR OF CERVICAL CORD. DIAGNOSIS. REMOVAL IN TWO-STAGE OPERA- TION; GRADUAL IMPROVEMENT*

By F. X. DERCUM, M.D., AND J. CHALMERS DA COSTA, M.D.

The case which we herewith place on record is interesting and important from several points of view. Especially has it to do with the recognition and interpretation of pain of spinal origin. The significance of such pain is frequently overlooked, especially when it is slight in character or ill defined. At times too it is incorrectly ascribed to a visceral origin and under such circumstances has led, as we all know, to futile abdominal and other operations. Again even when the pain is suspected of being spinal in origin the descriptions by the patient both of its character and distribution may be so vague as to render its interpretation exceedingly difficult. Secondly the case we have to report is interesting because of the relatively rapid and extensive development of symptoms suggesting a diffuse affection of the cord, such as a myelitis, rather than a local lesion. Further, the case is interesting because of the serological findings; and finally because of the diagnosis of tumor and the successful localization and removal of the latter.

Briefly the case is as follows: J. Y., aged twenty-five, single, white, native, and a hotel keeper by occupation, was admitted to the Jefferson Hospital on January 27, 1916. The chief symptom complained of was paralysis of both legs.

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The family history was without significance. Father died of heart disease in middle life; mother, three brothers and three sisters living and well. There is no history of cancer or tuberculosis.

The personal history revealed of the childhood diseases merely chicken-pox. The patient had never had pneumonia, typhoid fever, malaria, influenza, rheumatic fever or tonsillitis. He had had gonorrhea twice, once when seventeen years of age and again at twenty-one. He denied luetic infection. Admitted that he used both beer and tobacco freely. Had never had an accident of consequence.

The first symptoms of his present illness appeared in the latter part of October, 1915. He noticed at that time some pain or numbness vague in character in the left shoulder. The shoulder did not hurt him when it was moved or handled; however, numbness gradually made its appearance in the left arm and a little later still, distinct weakness of the left arm. The patient also states that if he coughed or jarred himself in any way he had a sensation as of a "thrill going through his body." Soon numbness with pain made its appearance in the right arm as well and this also was accompanied by weakness. The pain was at no time severe in either arm or shoulder. It was the feeling of numbness of which the patient especially complained. Soon he experienced a feeling of weight, pressure or hardness over the abdomen and in about one month after the initial symptoms had made their appearance, he experienced weakness in both legs. Walking became difficult and soon there was loss of sensation and paralysis in both legs. Bladder difficulties, retention of urine and later incontinence also made their appearance.

When admitted to the Jefferson Hospital, he was completely paraplegic and there was absolute loss of sensation to all forms as far as the level of the second rib. There was incontinence of both bladder and bowels and a large bed-sore over the buttocks.

A patellar reflex was elicited upon both sides; it was perhaps a trifle plus. There was no ankle clonus. There was, however, a Babinski sign upon both sides.

Both arms were weak. Movements were best preserved at the shoulders and in the upper arms. There was marked weakness of both forearms and hands. The hands assumed the position of wrist drop especially the left; the wrists, however, could be extended at will, though there was inability to properly extend the fingers. There was marked general wasting of the hands, forearms, arms and shoulders, as well as of the trunk and of the lower extremities. The lumbricales, both the thenar and hypothenar eminences and to a smaller extent the interossei were wasted in the left hand. Similar changes were noted in the right hand, though they were less marked; the lumbricales seemed in a large measure to have escaped. Hypesthesia to all forms of sensation, but very moderate in degree, was present in both hands and arms and disappeared when the shoulders or neck were tested. The pains which had been noted in the beginning of the case were at the time of admission to the hospital no longer present, merely a sense of numbness in the

shoulders and arms. Both legs and the entire trunk were anesthetic to all forms of sensation up to a line about midway between the first and second ribs. Here the anesthesia passed through a narrow intervening band of hypesthesia to fully preserved sensation. An area of hyperesthesia was not present.

There was no involvement of the muscles of the neck, head or face. The pupils were equal, average in size and reaction to light. The tongue was protruded in the median line.

The general visceral examination was negative, except that the first sound of the heart was slightly roughened. There was also a slight purulent discharge from the penis. An examination of the urine revealed a trace of albumen and a few pus cells.

A Wassermann examination of the blood proved negative. The spinal fluid revealed no unusual pressure. It also proved negative to Wassermann; it, however, contained 21 lymphocytes to the c.mm., revealed a marked globulin content and reduced Fehling. Finally it was rather striking in the fact that it was pale yellow in color. It may be stated incidentally that a test for bile salts proved negative. A culture of the spinal fluid also yielded a negative result.

Urethral smears revealed many pus cells, a few pneumococci and an occasional gram negative intracellular diplococcus.

A von Pirquet test proved negative.

The patient was repeatedly examined and but little change was noted in the symptoms subsequently save that some two weeks later the pupils were found to be somewhat unequal the left being larger than the right. An ankle clonus also appeared upon the left side.

An examination of the eyes by Dr. William M. Sweet revealed the right pupil to be 3 mm., the left $3\frac{1}{2}$ mm. Both reacted to light and convergence. The eye grounds were normal save that the veins were rather full and somewhat tortuous in the left.

An X-ray examination of the cervical and dorsal vertebræ was negative.

Save for the history of the initial pains in the shoulder, the case, to casual observation, might have suggested a diffuse myelitis, but the diagnosis of tumor of the cord, probably intramedullary, was deemed justified. Dr. J. Chalmers Da Costa, who was now consulted, concurred, and an exploratory operation was recommended. The patient's general condition was very bad; he was weak and emaciated and it was some time before his consent or that of his relatives could be secured. Finally on February 21, 1916, the operation was undertaken.

An incision was made over the fourth, fifth, sixth, seventh cervical and first dorsal vertebræ and the processes and laminae of the seventh cervical and first dorsal vertebræ removed. On opening the dura very little fluid escaped and there was no pulsation. The dura and subjacent pia seemed to be adherent. When the dura was removed several small white patches suggesting tubercles were noted on the surface of the cord. The cord which did not present an appearance of distention—at least not markedly so—was then incised. The incision which was at first very minute was of course longitudinal in direction and made on the left side of the cord over

the median lateral column, less than an eighth of an inch from the longitudinal fissure. Immediately a dark, bluish-red mass began to extrude. The incision was gently enlarged until it was about an inch in length. The mass, which seemed to be smooth and soft, continued to extrude. It seemed to be detaching itself without apparent injury to the columns of the cord. It was evident that dissection would damage the cord and it was decided to follow Elsberg's plan. Oozing rendered the use of gauze necessary. So small pieces of iodoform gauze having been paced lightly about the cord, the skin edges of the wound were closed and the patient returned to his room in very good condition.

He reacted well from the operation and, save for pain in and about the site of the operation, was very comfortable. His case progressed without incident save that some three days later he believed that he could tell which foot was being touched. Five days later he was again submitted to operation, the wound was re-opened and the cord was again exposed. The extrusion of the tumor-mass had evidently continued, though part still remained in the cord. The edges of the incision had become considerably separated and the tumor was now gently coaxed or teased from its bed in the cord with the aid of small pledgets of gauze. The tumor was exceedingly friable and soft and came away only in small fragments. Finally every particle appeared to have been removed. The wound was then closed and the patient returned to his room in good condition. The subsequent surgical course was without incident.

The tumor had involved in part the eighth cervical and the first and second dorsal segments of the cord. Because it was very soft and friable, its shape and size could not be accurately determined but it appears to have been considerably over an inch in length and a half inch in diameter. The cavity left after its removal was quite noticeable in size. A microscopical examination revealed it to be an angio-endothelioma.

Within twenty-four hours after the operation, the patient became cognizant when the left leg or foot was touched. Curiously enough he felt the touch as something hot or burning, and he could not localize the impression save to say that it was the left limb which was touched. It was noticeable also that the reflexes both deep and superficial had disappeared. Subsequently, however, they were again elicited as before. Within a few days the hypesthesia of the hands and arms grew markedly less and soon disappeared. This was followed by a rapid gain in power over the movements of the fingers, hands, wrists, forearms and indeed of the upper extremities generally. The improvement in the right upper extremity was somewhat more rapid than in the left. Twelve days after the operation the patient was able to abduct distinctly the left thigh. He complained of needle and pins feeling in both legs. Once or twice slight movements were noticed in the toes.

On March 7, he distinctly recognized touch upon the left leg, but still maintained that it gave him a sensation as of something hot. Little farther progress was noted until April 11 when it was found that he could slightly flex the thighs; both lower extremities could

be drawn voluntarily toward the body. The knee jerks responded normally; a slight ankle clonus was elicited on the left side, and Babinski upon both sides. It was also found that the area of anesthesia on the trunk had receded, so that the patient readily recognized tactile impressions as low down as the level of the fifth rib upon both sides.

Subsequently he began to notice distressing sensations in the bladder and on April 15 complained of severe pain in the bladder. Previously of course the patient had had no consciousness of any portion of his trunk and lower extremities and the fact of his being able to recognize pain in the bladder was very significant. A tangible cause for the pain was soon revealed by the evidences of a cystitis and a somewhat alarming rise of temperature. Both symptoms were brought under control but the ability to recognize bladder sensations persisted.

Improvement in the sensation continued so that by April 22 it had been recovered in a large measure over the entire trunk. Tactile impressions were clearly recognized as such, but upon the legs tactile impressions were still interpreted as heat and burning. The patient was also able to move the lower extremities, *e. g.*, flexion or abduction of the thighs, slightly, but as regards motion the improvement had not kept pace with the improvement in sensation.

On April 27, 1916, the patient is again examined. He had been under treatment for some days by vaccine therapy for the cystitis and had had some febrile reaction. At this examination the level of the anesthesia upon the trunk is a little below the level of the fifth rib, both anteriorly and posteriorly. Above this level the sensation to all forms is well preserved. Hypesthesia in the arm has now disappeared; sensation in the upper extremities, upper portion of chest and shoulders is apparently normal. Patient still mentions pain in his bladder. Though he had previously recognized touch upon the abdomen and elsewhere upon the trunk, his answers below the fifth rib are now doubtful. He is immediately aware when the left leg is touched, especially in the region of the calf. The impression is not felt as touch, however, but is still translated into a burning sensation. Is able to recognize hot and cold fairly well over the left lower extremity, though this ability grows less and is gradually lost as the trunk is approached. Is unable to appreciate tactile impressions in the right extremity at present examination. He recognizes and correctly describes passive movements made at the hips and knees. He does not recognize movements of the ankle or of the toes. The knee jerks are present, left somewhat more pronounced than the right. An ankle clonus is present upon the left, not upon the right. Babinski is present upon both sides, more marked upon the left. As far as the sensory findings are concerned, the improvement is less manifest than at the previous examination. He fails to recognize or localize tactile impressions upon the chest or abdomen below the fifth rib. It is of course possible that this is related to his general condition. In other respects the improvement has continued, though it has been slow.

The success attending both the localization and the removal of an intramedullary tumor of the cord cannot be recorded without paying tribute to the work of Elsberg, the pathfinder in this field.¹ We all recall the brilliant results attending his very first case, in which the patient not only recovered the power of walking but actually returned to work, as well as gratifying results attending many of the ten or more cases upon which he operated subsequently. The introduction of the principle of incising the cord and thus to bring about the extrusion of the tumor, itself a purely automatic and spontaneous act, marks a veritable epoch in the history of spinal surgery. How successful it was in the case here reported we have already pointed out. Roepke, Schultze, Foerster, Krause, and others have operated on intramedullary tumors with some degree of success. Roepke² states on the basis of his own case that encapsulated intramedullary tumors can be removed without damage by incising the substance of the cord in the middle line and carefully shelling out the growth. Spontaneous extrusion of the growth would seem to be the safer procedure.

Before dismissing this case from further consideration, it is interesting once more to recall some of its salient features in relation to diagnosis. First among these is the illusory and insignificant character of the pain. Pain was no longer present when the patient was first seen at the hospital, merely a vague sensation of numbness; pain as such had disappeared. There was secondly the sensation of "hardness" and "weight" over the abdomen which taken together with the paraplegia, anesthesia, sphincter losses and bed-sore, could readily have allowed the diagnosis of a diffuse myelitis to have been made. The history, however, of initial pain, ill-defined as it was, and the fact that it was in the beginning limited to one upper extremity but soon became bilateral, gave a distinct clue to the case. The growth was apparently so situated as not to give rise to root pain save very indirectly and this we believe to be one of the instructive lessons of this case. The growth was completely contained within the substance of the cord, though covered posteriorly by merely a thin layer of white matter.

Again, the fact of the xanthochromia of the spinal fluid is of interest. That it was not due to bile salts was readily demonstrated; it did not appear to be due to altered blood such as might have gained access to the dural sac; it therefore seemed directly referable

¹ See especially, *Surgical Treatment of Intramedullary Affections of the Spinal Cord*, Seventeenth Int. Congress, 1913, Section XI, Neuropathology, Part II, p. 187.

² *Archiv f. klin. Chirurgie*, 1911, Vol. 96, p. 963.

to the pathological process in the cord. Xanthochromia, as is quite well known, has been a not infrequent finding in tumors of the cord. Roepke regards a large amount of protein content, a yellow coloration of the spinal fluid, with a small increase of cell content, taken together with the clinical findings, as of great importance in the differential diagnosis between tumor of the cord and multiple sclerosis and spinal lues. He believes that the high percentage of protein content and the yellow fluid stand in close relation to each other; he thinks that they result from the disturbances of the circulation caused by the space-encroachment of the tumor. It is noteworthy that especial stress was also laid by Schultze³ on this feature in the case of a tumor which was partly extra- and partly intradural and in which the spinal fluid was yellow, coagulated and contained a large amount of protein. The question suggests itself whether the fact that the growth in the case here reported was an angio-endothelioma, *i. e.*, was unusually vascular, did not in some way account for the change in color of the cerebrospinal fluid.

³ Deutsche med. Wochenschr., 1912, p. 1676.