INTRAMEDULLARY TUMOUR OF SPINAL CORD: TREATMENT BY LAMINECTOMY AND APPLICATION OF RADIUM.

BY

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THE following case is one of intramedullary tumour of lumbo-sacral region of cord, found irremovable at operation, some weeks later treated by placing a tube containing 50 mg. radium for twenty-two hours in the spinal canal, with the result of steady and progressive improvement in movement and sensation in the previously paralysed lower limbs, until the onset of an acute cystitis with *B. coli* infection wore out the patient's strength and caused her death.

History.

The patient, a single woman aged 26, was by occupation a typist, and had had no previous illness. In May, 1913, she had a curious itching feeling in the right thigh, followed in June by pains in the right hip and thigh causing her to limp. At the end of June pains in the back, in the right lumbar region, of sharp, shooting character came on and were increased by turning the head. In July the pains and superficial tenderness in the right leg were so severe that she bandaged it to prevent rubbing with the clothes. From July 14th she could no longer go to work, and on July 30th took to bed for a month. At this time she could not walk without support. At the end of August the pains "changed over to the left hip and left the right leg numb." After further rest in September she improved, and the pains were less, but from this time she had difficulty and great frequency in micturition, with burning pains in the bladder.

Condition on Admission.

She was sent to Bristol General Hospital by Dr. F. A. Mayes on October 11th, and in addition to bladder troubles complained of "pains like a stitch in the back, stiffness and pains in the legs, and inability to walk through being unable to balance."

She was in a very nervous state, and had symptoms of thyroïdism, evidenced by a symmetrical general enlargement of thyroid, which was soft, a rapid pulse (120 to 130), fine tremor of the hands, and a moist skin; these symptoms were present more or less throughout the illness. The thoracic and abdominal organs were normal except for a soft systolic murmur at the base of the heart. There was some difficulty in defaecation, due to the pain in the back.

She could not stand without support, and could only walk a few paces supported on each side. There was no deformity or tenderness of the vertebral column. The muscles of the lower extremities were flabby and flaccid, and somewhat wasted below the knee; there was double foot-drop, with internal rotation of the feet; the abductors of the thighs were weak. When lying down she could lift the left leg off the bed but not the right; she could not move the toes of the right foot; there was distinct hypotony of muscles of lower limbs. With a strong faradic current, to which she was not very sensitive, the muscles of the thighs responded well, those of the left leg and foot fairly, and those of the right leg very feebly or not at all.

Affection of sensation was indefinite at this date—probably there was some loss to pain and temperature over the right leg, and she stated that "she had no feeling of having a right foot." Except in this foot no loss of sense of movement or of position was made out. Tactile sensation (cotton-wool) everywhere normal. Reflexes—knee-jerks, ankle-jerks, plantar and lower abdominal absent, the others present.

For the first month after admission she improved, the pains and irritability of the bladder were much better, and she could walk about a little by pushing a chair in front of her. After this she became worse again, and her condition on November 26th was as follows:

Severe pains in right lumbar region of back, in legs, especially at back of knees, and tenderness and pain over sacrum. Frequency of micturition, with burning pain at commencement; she passed water at least twenty times a day, and shortly after this date retention of urine came on, and the catheter had to be passed every three or four hours to keep her in even tolerable comfort. The urine was acid, clear, and contained no sugar or albumin. The catheter was always used with careful antiseptic precautions. The bowels were constipated. She could now stand only if supported on each side, and could not walk. Extension of the legs caused pain, and the legs were drawn up and becoming contracted in that position. Complete double foot-drop. When lying down there was some action of the ilio-psoas, otherwise the right lower extremity was completely paralysed. The left foot and ankle were also completely paralysed, but she could just raise this limb off the bed. There was marked wasting of all muscles of both legs below the knees, and of the right quadriceps extensor.

Electrical Reactions.—To faradism very faint reaction with strong current of the right dorsiflexors of foot and calf muscles, feeble reaction of some muscles of left leg, and of right quadriceps and hamstrings. The left quadriceps extensor acted well. No reaction obtained in glutei.

To the constant current the reactions obtained in the same muscles were feeble but everywhere KCC > ACC. For sensation see Fig. 1, to which it should be added that sensation was normal over the perineum, in the vagina and rectum, that there was some indefinite loss to pain (pin-prick) over lower part of back, and that over the left leg cold (ice) was always felt as warm. The reflexes were as stated above. There were no trophic lesions. The cerebro-spinal fluid showed no increase of cells, a great excess of serum globulin, and much yellowish pigment (lutein).

Fig. 1.—November 26th. Light touch, normal. Horizontal broken lines = lost or defective sensation to pin-prick. Oblique continuous lines = lost or defective sensation to heat and cold (ice). Note, over left leg, ice felt as "warm" everywhere.

The patient's condition up to this time showed a steadily progressive deterioration.

It was considered that she was suffering from a tumour in the lumbo-sacral region, that it was probably intramedullary because of the loss of reflexes, absence of spasticity, muscular wasting, and some differentiation in the sensory loss.

Operation.

An operation was accordingly done on December 3rd.

The spines and laminae of the eleventh and twelfth dorsal, first and second lumbar vertebrae, were removed. On opening the dura mater a bluish haemorrhagic patch was seen on the posterior surface of the lumbar enlargement, which was much enlarged and felt indurated. On retracting the cord to the left a large growth, bluish in colour, was seen and felt within the substance of the cord. It was largest at the level of the eleventh dorsal spine, and was probably about 1½ in. in length. As it was obviously impossible to remove it without destroying the cord for a considerable extent, and it was considered that this would also be the result if the cord were incised and the tumour allowed to extrude spontaneously, and the patient had been promised that she should not be left any worse by the operation, the dura was sewn up and the wound closed.

The effect of the operation, probably from relief of pressure, was that the pains were somewhat less; she recovered some power in the left thigh, being able to lift the leg high off the bed, and the bladder was less irritable, the catheter being required only every six hours, there being still retention.

Application of Radium.

As six weeks later her condition was otherwise unchanged, and was a hopeless one from the point of view of ordinary medical or surgical treatment, it was thought that the application of radium to the cord might be tried.

Condition on January 21st: Reflexes same as before. The muscles of each calf and the right quadriceps extensor were much more wasted. There was complete foot-drop, and no power of movement of any muscle below the knee in either leg. The left lower extremity could be raised well off the bed, the right only about an inch: the

left knee could be flexed and extended, and the right knee very slightly so. Fig. 2 shows the sensory disturbance at this time; in addition the sense of position of movement was lost in the whole of the right lower extremity, but was present in the left, except in the great toe.

Fig. 2.—January 21st, 1914, before radium. Deeply shaded areas = loss of sensation to pain, light touch, heat, and cold; elsewhere light touch normally felt. Oblique lines = heat and cold not distinguished; both called "warm." Horizontal broken lines = pinprick not felt, or only as touch.

She was unable to stand or walk, and was therefore paraplegic, with considerable loss of sensation and with retention of urine.

On applying to Mr. Hayward Pinch, of the Radium Institute, he kindly supplied 50 mg. of radium in a specially devised tube, so that it could be placed alongside the spinal cord in the spinal canal. On January 28th, 1914, the wound was reopened, and the tube placed alongside the cord over the tumour, outside the dura mater, fixed in this position, and left there for twenty-two hours.

Some days later she began to show slight signs of improvement, and there was great relief of pain. On February 18th, although there was still complete foot-drop, she could move the toes of the left foot, she could draw up either leg, raise it off the bed, could flex and extend the knees, and could also raise both legs off the bed at the same time. She could also sit up in bed and raise herself to a sitting posture without the aid of the arms. The legs were no longer drawn up, but could be kept extended in bed in a natural condition without pain. For the first time for many months the feet felt warm.

Shortly afterwards she was able to sit up in a chair, and by March 3rd she could sit up for some hours, could stand unsupported for a few moments, and was able to take a few steps without support. The double foot-drop which persisted was, however, a great hindrance to movement. The muscles below the knee on the right side were degenerated, and did not react to faradism, and on the left there was a feeble reaction in the tibialis anticus and peronei only. The improvement in sensory disturbances is manifest from Fig. 3. The retention of urine continued, and no urine was evacuated without the catheter, which was always carefully sterilized.

Unfortunately at this time the bladder again became more irritable, and she had an attack of acute cystitis, with alkaline, offensive urine containing a quantity of pus. There was also much bladder pain, and, being always a nervous girl, and now weak from her long illness, the pain and loss of sleep upset her altogether. She was constantly crying out for the catheter, and at times was in a greatly excited, semi-delirious state, when it was very difficult to pacify her. The temperature was only slightly raised at first, but about March 18th and afterwards it rose to 102° and 103° every night. The urine was found to

Fig. 3.—February 18th, 1914, twenty days after radium. Tactile sensation (cotton-wool) normal, except over dark shading. Right leg, dark shading = sensation lost to pain, light touch, heat and cold. Right leg, broken horizontal lines = pin felt as touch only. Left leg, oblique lines = heat and cold (ice) not distinguished, both called "warm." Localization good.

contain *B. coli*, and the amount of pus and blood was so great as to suggest the severe cystitis that accompanies a stone or growth in the bladder. An autogenous vaccine was prepared as soon as possible; two doses were given, but without effect. She rapidly lost strength, and died on March 27th, apparently from exhaustion. No *post-mortem* examination was permitted.

Conclusion.

This result was very unfortunate and most disappointing, as it seemed before the onset of the cystitis that the treatment by radium was likely to result in a considerable degree of recovery, possibly nearly complete recovery; and it is for this reason that the case is published, as it seems to show that it would be worth while to try a similar procedure in a case of the same kind.

The progress of recovery after the use of radium can be best compared to that seen in cases of extra-medullary tumour of spinal cord after the removal of the growth, and was proceeding at about the same rate and in the same way and order as in those cases—that is, relief of pain, recovery of sensation in least affected areas, recovery of power in least affected muscles, and in those which had not undergone degeneration. In the muscles below the knees which had been wasted and degenerated for some time, recovery could in any case not be expected for many months, and probably would not be complete. The bladder disturbance was throughout one of the chief difficulties in dealing with the case; it may have been aggravated by the fact that she had worked for a long time in an office where there were no sanitary conveniences, and she would go all day without passing water. In the early part of her illness she often did not pass water for twenty-four hours.

Lastly, a word of reference may be made to the yellowish pigment, lutein, in the cerebro-spinal fluid. In our experience at the Bristol General Hospital this pigment has never been found in the cerebro-spinal fluid except in cases of tumour, and its presence may be taken as a valuable confirmatory sign.

ON THE RESPECTIVE ADVANTAGES AND DISADVANTAGES OF X-RAYS AND RADIUM IN THE TREATMENT OF CANCER.

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THE activity of radium is often looked on as something mysterious and apart—as a phenomenon having no parallel elsewhere in nature. The truth is, that a very close similarity exists between the radiations of radium and those given off by an x-ray bulb.

Sir William Crookes, by whose name the modern x-ray tube is still sometimes called, announced more than thirty years ago that substances may exist in a state where atomic—that is, elemental—distinctions no longer hold; and in speaking of his discoveries he used the prophetic term, *radiant matter*. The best known form of radiant matter is the electron, or particle charged with negative electricity. Normally, electrons are bound up with atoms, but they may be set in linear motion either artificially, as when a current of high potential electricity is passed through a vacuum tube; or spontaneously in certain elements, notably radium. When an electron is either violently accelerated or suddenly stopped, a pulse or wave is produced in the ether, which, when proceeding from a highly exhausted Roentgen bulb, or from a piece of radium, has remarkable powers of penetrating matter. In the case of the former, a stream of electrons from the cathode or negative pole is made to impinge on a platinum target, and the desired ether pulse is produced by their stoppage; but in the case of the radio-active elements, atomic explosions are continually going on, and electrons are shot out with extreme violence. At the moment of emission ether pulses are generated comparable with those proceeding from the target of a Crookes tube.

* Read before the Darlington Division of the British Medical Association.