

A case of tumour of the spinal cord : removal, recovery / by W.R. Gowers and Victor Horsley.

Contributors

Gowers, W. R. 1845-1915.
Horsley, Victor, Sir, 1857-1916.
Royal College of Surgeons of England

Publication/Creation

London : Printed by Adlard and Son, 1888.

Persistent URL

<https://wellcomecollection.org/works/z7hjgtuq>

Provider

Royal College of Surgeons

License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

A CASE

12

OF

TUMOUR OF THE SPINAL CORD.

REMOVAL; RECOVERY.

BY

W. R. GOWERS, M.D., F.R.S.,

AND

VICTOR HORSLEY, B.S., F.R.S.

Read June 12th, 1888.

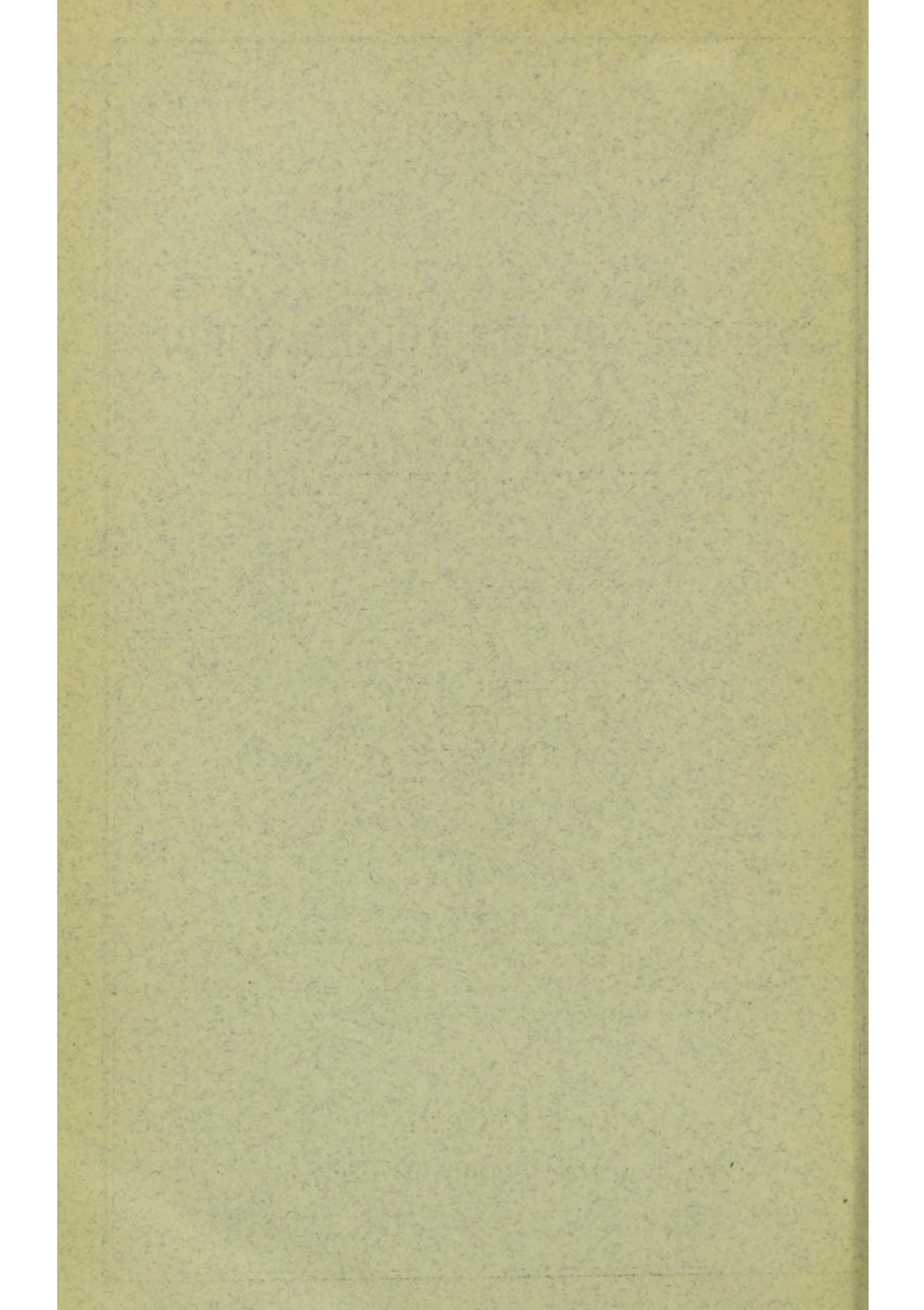
*[From Vol. LXXI of the 'Medico-Chirurgical Transactions,' published
by the Royal Medical and Chirurgical Society of London.]*

LONDON:

PRINTED BY

ADLARD AND SON, BARTHOLOMEW CLOSE.

1888.



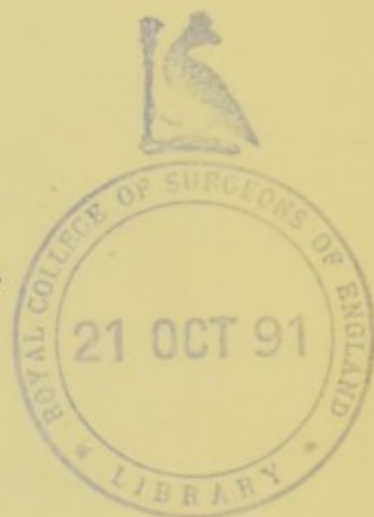
A CASE
OF
TUMOUR OF THE SPINAL CORD.
REMOVAL; RECOVERY.


BY
W. R. GOWERS, M.D., F.R.S.,
AND
VICTOR HORSLEY, B.S., F.R.S.

Read June 12th, 1888.

*[From Vol. LXXI of the 'Medico-Chirurgical Transactions,' published
by the Royal Medical and Chirurgical Society of London.]*

LONDON:
PRINTED BY
ADLARD AND SON, BARTHOLOMEW CLOSE.
1888.





Digitized by the Internet Archive
in 2016

<https://archive.org/details/b22459996>

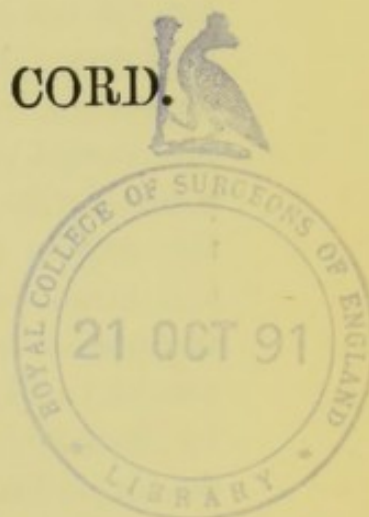
A C A S E
OF
TUMOUR OF THE SPINAL CORD.
REMOVAL; RECOVERY.

BY
W. R. GOWERS, M.D., F.R.S.,
AND
VICTOR HORSLEY, B.S., F.R.S.

Received March 8th—Read June 12th, 1888.

Medical History of the Case, by Dr. GOWERS.

CAPT. G—, æt. 42, had good health until the year 1884. There was no history of syphilis. During 1883 and 1884 he endured much mental anxiety, and in the latter year he had a considerable mental shock—his wife was knocked down and run over in his presence, and he was able to save himself from a similar fate only by suddenly throwing himself backwards. Soon afterwards he began to suffer from a dull pain across the lower part of the back, which he thought was due to the strain of the accident. This pain passed away in the course of a few weeks and did not return. In June, 1884, he first felt a peculiar pain that was the most



prominent symptom during the early part of his illness. It was localised in a spot beneath the lower part of the left scapula. This pain commenced suddenly one day while he was walking, and was continuous and severe for about a month. It was increased by active exertion and by the jolting of a carriage. Repeated examination failed to reveal any cause for it. After a time it became less, but was felt occasionally through the autumn and winter. By the spring it had all but ceased, and he was asked to go out to China on business. Before undertaking the journey he consulted a physician in London, who pronounced the pain to be an intercostal neuralgia and suggested that the voyage would probably do good. While Capt. G— was in the train, on the way to Brindisi, the pain returned in severe degree, at the same place, and of the same character. During the voyage it continued, varying in severity, but when he reached China it was so intense, and was so much increased by movement, that he could scarcely walk. A German doctor at Shanghai, after a course of Turkish baths had been tried without benefit, expressed the opinion that an aneurism was the cause of the pain. Digitalis and iodide of potassium were given, and the latter was increased to large doses by two English practitioners at Shanghai, who doubted, however, whether there was an aneurism. The pulse became curiously variable, changing from 120 in the morning to 75 in the afternoon. The pain continued, and some fainting attacks occurred, one of which was thought to be possibly epileptic in character. In October, 1885, still suffering much and very prostrate, he left China for England. During the voyage he improved in health, the faintings ceased, and the pain lessened, so that in December, 1885, he could walk a little. Walking had been interfered with only by the pain. Other physicians were consulted, and the rest of the winter was passed in the South of France. The improvement continued, and by the spring of 1886 he was so much better that he went on to Constantinople on business. While there the pain almost ceased. He returned to England in the middle of the summer, and, as the pain

was still felt a little at times, he consulted other physicians and by them was sent to Aix-la-Chapelle. While he was there the pain returned in great severity and morphia was injected. In September, 1886, he returned to England, and the pain was then very severe, and, as before, was increased by movement so that he was again scarcely able to walk. The morphia was stopped and blisters applied. An aneurism was again suggested as the probable cause of the symptoms, and the use of morphia was resumed for a time, but was again discontinued at the wish of the patient himself. He became irritable; the continued pain seemed to lessen his power of self-control. So marked, indeed, was his mental state that the question was seriously raised whether he was quite sane, and whether this mysterious pain was anything like as severe as he described. He continued in this condition till the end of the year. In February, 1887, he again came to London for advice and consulted two physicians, who expressed the opinion that there was no organic disease and advised him to go abroad. During February and March there came on distinct loss of power in the legs. The left leg first became weak and a few weeks afterwards the right. In April he went abroad, and remained away from England for two months. During this time the weakness increased to complete loss of power, sensation became impaired, and the urine was retained in the bladder. Still the mental peculiarities were so conspicuous to those around him that fresh doubts were felt as to the reality of his symptoms, and it was suggested by someone that he should be put through a course of the Weir-Mitchell treatment. Before this step was taken another opinion was thought desirable, and the patient was brought to London for the purpose on June 4th. I saw him on the following day, in consultation with Dr. Percy Kidd, who was connected with the patient but had not had anything to do with the previous treatment.

The condition then presented by Captain G— was that characteristic of grave organic disease of the dorsal region of the spinal cord. There was absolute motor palsy of the

legs, and cutaneous sensibility of all kinds was lost as high as the ensiform cartilage. At and just above this level, that is, in the region of the sixth and seventh intercostal nerves, he complained of severe pain around the chest, much more severe on the left side than on the right, and increased to evident agony on any movement. The legs from time to time became rigid in extensor spasm, and a clonus could be obtained with great readiness in the muscles of the calf and front of the thigh. The paroxysms of spasm involved also the muscles of the abdomen. The bladder was distended, and the urine that was drawn off contained pus. There was no irregularity of the vertebral column, nor could tenderness be discovered in any part. No trace of pulsation could be felt in its vicinity, and no murmur could be heard on auscultation. The thoracic organs seemed healthy, and both lungs were equally filled with air.

The development of complete paraplegia, which had taken place during the preceding four months, rendered the diagnosis, up to a certain point, a simple matter. The symptoms were those characteristic of a transverse lesion of the cord a little above the middle of the dorsal region. The gradual onset of the paralysis, the affection of one leg before the other, and the long-preceding signs of nerve irritation at the level of the lesion, made it practically certain that the spinal cord was damaged by compression and that the cause of the pressure was outside the cord itself. Caries of the spine was excluded by the absence of any irregularity of the spines or tenderness, taken in conjunction with the long duration of the symptoms. The diagnosis lay between an aneurism eroding the vertebræ and compressing the cord, a growth springing from the bones of the spine, and an intraspinal tumour within the canal, but outside the cord itself. Although aneurism could not be completely excluded, the absence of any of the characteristic physical signs of aneurism, and the absence of any indication of weakening of the spinal column, made this cause of compression far less probable than one of the two others. The distinction of a

tumour of the bones from one within the canal can only be a matter of certainty when the enlargement of the bones, caused by the former, can be felt. In other cases the diagnosis can only be a matter of probability, and often of very low probability. A growth backwards from the bodies of the vertebræ may cause symptoms undistinguishable from those due to a tumour springing from the membranes. In this case, however, the symptom of longest duration, the pain, pointed to irritation of the posterior roots on the left side, and therefore to a lateral position of the growth, and the affection of the left leg before the right had the same significance. A growth from the bone on one side of the cord would be more likely to cause recognisable enlargement of the parts, than would one springing from the bodies of the vertebræ, and the absence of such enlargement in this case was therefore somewhat in favour of the growth being altogether within the canal.

The course of the symptoms, coupled with the inutility of iodide of potassium, precluded the supposition that the disease was syphilitic. The long duration of the symptoms in slight degree was in favour of the non-malignant character of any growth that might exist.

In a description of tumours within the spinal canal,¹ I had previously suggested that the removal of spinal meningeal growths would be not only practicable but actually a less formidable operation than the removal of intracranial tumours. In this case the patient and his friends were exceedingly anxious that something should, if possible, be attempted. An operation gave a chance, the only chance, of cure. If the tumour should turn out to be one that could not be extirpated, it was possible that the removal of an arch, or the division of nerve-roots passing into the growth, might lessen the sufferings of the patient. If nothing were done, death after months of intense suffering was inevitable.

Sir William Jenner saw the patient with Dr. Percy Kidd and myself, and concurred in the probable diagnosis of a growth. The question of an operation was submitted to

¹ 'Manual of Diseases of the Nervous System,' vol. i, p. 432.

him and received his sanction, provided the patient himself clearly understood the nature of the operation and that a perfectly successful result was not more than a possibility. Capt. G— was, however, only too anxious to submit to anything that held out the faintest hope of relief. Accordingly Mr. Horsley was asked to see the patient, and, if he saw fit, to operate.

Surgical History of the Case, by Mr. VICTOR HORSLEY.

I saw Captain G— on the 9th of June, 1887, at 1 p.m. The patient was half sitting up, complaining of paroxysms of very great pain in the lower limbs and abdomen, the former being completely paralysed and frequently flexed in clonic spasm, the pain accompanying which was so severe as to cause the patient to cry out. On careful examination of his spine, there appeared no undue prominence of any vertebra, and the only abnormality detected was tenderness on pressure to the left side of the sixth dorsal spine. This was very constant though slight; on movement the patient complained of a sensation of weakness (rather than pain) referred to the middle of the dorsal region, but such movement did not seem to start the spasm in the legs by interference with, or pressure upon, the spinal cord. He was very loth to move because it necessitated voluntary change of position of his legs, movement of any of the joints of which was liable to bring on a severe paroxysm of painful flexion. In addition to the complete loss of motor power just noted, there was loss of tactile sensibility as high as, and involving the destruction of, the fifth dorsal nerve. There was some doubtful diminution of sensibility in the left fourth intercostal space, but this could not be satisfactorily demonstrated when I saw the patient.¹ On the right side the insensibility was limited to the fifth interspace. The anæsthesia was complete for all kinds of stimulus.

¹ This slight affection of the left fourth nerve was nevertheless of great diagnostic importance as the sequel of the operation shows (see p. 11).

There was complete loss of power over the bladder and rectum, and catheterisation had been found difficult with a metal instrument on account of the severity of the urethral spasm thus excited. (After the operation, when the spasmodic condition was equally severe, the passage of a soft rubber catheter was unattended by this trouble.)

The morning temperature during the week preceding the operation varied from 97.4° to 99.2° , and the evening temperature between 99° and 99.4° .

For the history and present state see the foregoing description by Dr. Gowers.

Operation.—June 9th, 3.30 p.m. Present: Drs. Gowers, Percy Kidd, and Edmunds. Mr. White anæsthetised the patient with ether while he was lying in the semi-prone position on the right side, and I was kindly assisted by Mr. Stedman and Mr. Ballance. The skin was shaved and thoroughly cleaned with ether and 5 per cent. carbolic acid solution, the spray was used throughout the operation, and the instruments and sponges were kept in 5 per cent. carbolic solution. Free incision was then made in the middle line through the skin and the subcutaneous tissues extending from the third dorsal spine to the seventh. The deep fascia and tendinous attachments of the muscles were then cut from the spines and a transverse cut was carried outwards from the spines over the spinous muscles through the vertebral aponeurosis, so as to prevent all tension on the sides of the wound. (See Remarks.) Vessels bled freely by the sides of, and between, the spinous processes, and were secured with Wells's forceps. The muscles were then completely detached from the spinous processes, from the laminae, and from the mesial aspect of the transverse processes. This was done in a way which I shall refer to later, namely, by free use of the knife, and subsequently blocking the wound with sponges, while the same procedure was carried out on the other side of the spinal column. The sides of the wound being now strongly retracted and most of the vessels ligatured, the spines and laminae could be seen perfectly.

The fourth, fifth, and sixth dorsal spines were then cut off close to their bases with powerful bone forceps, the laminal arch of the fifth vertebra was then trephined with a three quarters of an inch trephine, the pin being placed in the middle line. The bone was very hard and tough and one sixteenth of an inch thick. The rest of the laminae were then removed with a bone forceps and knife, the ligamenta subflava giving much trouble owing to their toughness. The laminal arches of the fourth, fifth, and sixth vertebrae being thus cleared away, the dura mater was easily exposed by an incision in the middle line through the fat covering it. This fat, being pressed aside, shrank and showed the dura mater of a normal appearance, colour, and tension. Nothing very abnormal was then observed, save that on the left side the dura mater was distinctly pressed nearer to the bony wall of the neural canal. This, of course, was due to the fact that the tumour lay on the left side of the cord, and consequently pressed the dura mater on that side closer to the vertebrae. The wound being practically bloodless, the dura mater was slit open in the middle line with a knife and dissecting forceps. The cerebro-spinal fluid escaped freely, but not with any undue pressure to signify pathological tension. The spinal cord was now exposed for about two inches and appeared to be perfectly natural in colour and density; moreover, the vessels coursing on its surface were in every respect normal.

It will now be readily understood that the upper part of the roots of the sixth nerve and the whole course of the fifth nerve on each side from the spinal cord to the intra-vertebral foramen was completely exposed. Examination of the spinal cord on all sides with the finger and cautiously with an aneurism needle failed to reveal anything abnormal. Another lamina was removed at each end of the wound, the dura mater as before slit up, and the cord still further exposed, but still nothing pathological was discovered. At this juncture it appeared as if sufficient had been done, but I was very unwilling to leave the matter undecided, and my friend Mr. Ballance being strongly of the opinion that

further exposure of the cord was indicated, I determined to go further if the state of the patient warranted me in so doing. Finding that his pulse was very strong, and that there would be no difficulty whatever in the anæsthetisation, I removed another lamina at the upper part of the incision. On opening the dura mater I saw on the left side of the subdural cavity a round, dark, bluish mass about three millimetres in diameter, resting upon the left lateral column and posterior root-zone of the spinal cord. I recognised it at once to be the lower end of a new growth, and therefore quickly cut away the major part of the lamina next above. This enabled me to see almost the whole extent of the tumour when the dura mater was divided. It was an oval or almond-shaped body of a dark, bluish-red colour, resting upon, and attached at its lower extremity to, the highest root of the left fourth dorsal nerve,¹ just where the posterior nerve-roots were gathered together in one trunk. On palpation the tumour markedly fluctuated. Above, it extended as far as the third dorsal nerve to which it appeared to be loosely attached by connective tissue, evidently a fold of the arachnoid. The tumour occupied exactly the position of the point of the ligamentum denticulatum, being jammed between the dura mater and the left side of the spinal cord. The pia mater and the arachnoidal sheath of the spinal cord evidently passed continuously from the cord over the surface of the tumour, forming a kind of capsule on its upper surface. At the same time it seemed as if the tumour could be pressed away from the spinal cord, so as to give the idea of its not actually invading the substance of the cord. I therefore made an incision through the pia mater sheath of the spinal cord, and then found that I could easily dissect the tumour from the surface of the cord, lifting it out of the deep bed which it had formed for itself in the lateral column of the cord. It was easily detached above by cutting through the loose tissue before described. Below, as it was firmly adherent

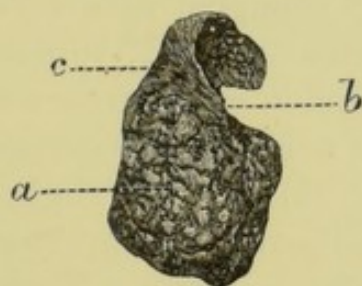
¹ The growth was found by measurement (at the operation) to be situated four inches above the level of complete anæsthesia.

to the fourth dorsal nerve, and as that nerve was of course of insignificant importance, I cut away the portion of nerve adherent to the growth. The outer border of the tumour was bathed in the cerebro-spinal fluid, and so required no dissection, but in removing the growth its inner surface, formerly of course in close contact with the cord, apparently gave way and some turbid serous fluid escaped, this reducing the volume of the tumour to about three fifths of its former size. (For description of the tumour *vide infra*.)

The cavity left by the removal of the growth was of course for the most part simply the subdural space, but the spinal cord was evidently greatly damaged by the pressure of the growth. The lateral column was so depressed or notched, so to speak, that the bottom of the groove in it nearly reached the middle line of the cord. It seemed likely, therefore, that most of the fibres in this column would be completely destroyed, moreover, there was evidently no resiliency in the damaged cord, for during the time that it was under observation the bottom of this pit showed no tendency whatever to rise. The surrounding adhesions of loose connective tissue oozed rather freely, but gentle pressure with a fragment of sponge for a few minutes soon arrested this bleeding. The cord and subdural space was then carefully sponged with 5 per cent. carbolic acid solution and freed from blood-clot. The edges of the long incision in the dura mater were then approximated (incision fully four inches) and laid in position but not sutured at all. The few remaining vessels were ligatured, and the sides of the wound brought together by strong silk sutures passed vertically with curved needles through almost the whole thickness of the side of the wound, and at a distance of about half an inch from the border. These sutures were placed at distances of about one inch, and on being tied firmly were found to readily approximate the two sides of the cavity close to the dura mater. The edges of the skin were carefully approximated with numerous horsehair sutures, a small superficial

drainage-tube was placed at the lower extremity of the wound, and a long drainage-tube was placed vertically to the dura mater and reaching so far as that membrane at the upper end of the wound. The whole was then covered with a strip of carbolic gauze dipped in 5 per cent. carbolic solution, and a carbolic gauze dressing applied. The patient was put back to bed.

THE TUMOUR.—The growth, on microscopical examination, was found to be fibro-myxoma. It presents a nodular appearance, and the cavity referred to on p. 12 was found to be on the inferior and outer surface, being such a cystic space as



From a photograph of the tumour (natural size).

a. Points to the lobulated surface of the solid portion of the tumour, this producing the excavation of the cord.

b. Points to the open cavity in the tumour, this cavity being ruptured during the removal of the mass.

c. Shows the fibrous capsule forming part of the inner wall of the cystic cavity, and consisting of simple connective tissue, thus contrasting with the myxomatous tissue at *a*.

might have resulted from a hæmorrhage. The wall of the cavity was found to be a false capsule derived from the pia mater and arachnoid. Unfortunately its contents were lost in the operation. The mass of the growth on section was pale and homogeneous, but indications of separation into nodular masses could be seen here and there. The tumour was enveloped, as already described, in a thin capsule, and consequently the parts will best be described under the headings of *capsule* and *substance*.

(1) *Capsule*.—The capsule was formed of very delicate connective tissue in which the ground substance was obviously mucinoid, and in which numerous corpuscles were

embedded. The corpuscles were (*a*) leucocytes with darkly-staining round nuclei, (*b*) connective-tissue corpuscles with feebly-staining oval nuclei. Numerous large vessels with very thin walls (those of the veins in fact showing but one or two layers of muscle-fibres at the most) coursed through the exterior of the growth.

(2) *Substance*.—*Stroma*.—The stroma of the growth was composed of mucinoid ground substance and trabeculæ of spindle-shaped connective-tissue corpuscles closely applied to one another.

Parenchyma.—These trabeculæ marked off round spaces, which were entirely occupied with myxomatous connective tissue, *i. e.* mucinous ground substance which shrank greatly in alcohol, and in which were numerous corpuscles of varied shape. The nuclei of the corpuscles were (*a*) round and darkly staining, (*b*) oval and slightly staining, (*c* and *d*) ellipsoidal and spindle-shaped, darkly staining, and (*e*) very elongated, also darkly staining. These latter were as long and slender as the nuclei of involuntary muscle-corpuscles.

(3) *Vessels*.—A very few vessels were visible in the substance of the growth, and there were very small arterioles and venules with delicate walls of adventitia.

(4) *Pigment*.—In very many parts of the sections numerous collections of hæmatoidin granules were visible. In some instances these were obviously in corpuscles. No signs of any recent hæmorrhage, *i. e.* within a year or two, could be found.

*Further Course of the Case.*¹

June 10th, 1887, 1 a.m.—Patient restless, complaining greatly of painful spasm in the legs and bladder, with sensation of distension of latter. Urine drawn off with soft catheter. The flow of urine was of the kind characteristic of complete paralysis of the bladder. No further change. Gr. $\frac{1}{4}$ of morphia given hypodermically.

¹ Owing to the length of the case it will be best to give as far as possible succinct *résumés* of the course of each leading symptom, &c.

9 a.m., temperature 97.6° F. (It may be stated here that the temperature throughout never reached 100° F., the highest recorded being 99.8° at 4 p.m. on June 11th, *i. e.* forty-eight hours after the operation. The temperature therefore will not be mentioned again, it being only needful to explain that its fluctuations were those of health, viz. low in the early morning and a little higher in the late afternoon.) Wound dressed, looked perfectly quiet. Tubes blocked with clot; cleared and replaced. Considerable amount of bloody serous discharge and cerebrospinal fluid in the dressing.

On turning the patient over, a proceeding which was always difficult on account of the very severe pain in the abdomen and the left lower limb more especially, there was found an erythematous raised patch on the left side of the sacrum, but extending also across the middle line to the right side. The patch was about four inches broad and about three inches in vertical length on the left side, but only one inch on the right side. The nurse was positive that before the operation there was no such decubitus, and none was observed at the operation. This patch was immediately protected with boracic ointment spread on lint, and need not be again referred to, since it gradually disappeared, although on June 13th part of it in the centre of the gluteal fold appeared dusky, as though threatening necrosis of the skin. Fortunately it simply dried up.

11th.—Pulse 112. (The pulse varied very slightly after the operation, the rate gradually falling, thus on the 12th it was 108, on the 13th 95, and it varied between 90 and 100 till complete convalescence. Nothing was to be found to account for the high rate, except the pain. The patient still complained of much constant burning pain in abdomen, bladder, and limbs, in addition to which he suffered from violent painful spasm in the bladder and left leg especially. The left lower limb frequently flexed in spasm, but the right very rarely.

It need scarcely be stated that the indescribably excessive pain under which the patient laboured made examina-

tion of the limbs, &c., practically impossible, since the least touch excited the most violent clonic spasm, followed by tonic spasm, *i. e.* rigidity in extension, such spasm being agonisingly painful.

Urine.—Sp. gr. varied from 1024 to 1030. Strongly acid, no albumen or sugar. The urine never altered throughout, save a little in specific gravity, and therefore will also not be again referred to.

12th.—Wound dressed, uniting by first intention, though the edges looked reddish.¹ Discharge slightly serous, but enormous quantities of cerebro-spinal fluid escaped. The smaller (*i. e.* the lower) drainage-tube was removed, the higher left in. (This was an error; the tube should always be left out on the second day, so as to prevent the formation of a sinus along which the cerebro-spinal fluid by escaping may cause serious annoyance.)

13th.—The patient still complained of the incessant pain keeping him without sleep. Hypodermic injections of morphia in half-grain doses only gave half-hour snatches of troubled sleep, therefore draughts of chloral and bromide of potassium were given (Hyd. Chlor. gr. xv, Pot. Brom. gr. xc in the twenty-four hours, and these were continued in gradually diminishing quantities during the succeeding weeks until about the end of September).

The bowels being constipated, an enema was given with result. The urine was drawn off whenever the patient felt it distend the bladder, *i. e.* about every six hours, and when the amount of urine was usually seven ounces. It is important to note that the patient said that the distension of the bladder increased the spasm of the abdominal muscles. This spasm was tonic and never (?) relaxed until some two months after the operation.

14th.—Wound dressed, union still perfect. Dressing soaked, but this was less marked than on the 12th inst. At 6 p.m. this day, *i. e.* on the fifth day after the operation,

¹ I have noticed this reddish colour of the edges and suture holes in another case where the cerebro-spinal fluid rendered the wound sodden, but in which nevertheless union also occurred by the first intention.

patient passed seven ounces of urine, and again at 9.30 p.m. six ounces. The micturition, however, was not "voluntary," but purely reflex action of the just recovered lumbar centre. The patient did not know when the urine escaped, although sensation was returning.

15th.—Sensation to touch now rapidly recovering, only the left foot being still anæsthetic. On account of the severe pain of the spasms excited by touching the limbs no further observations were made, *i. e.* as to transmission of painful impressions, of heat and cold, &c., but there is little doubt that as regards tactile and painful stimuli, sensation had returned by about the tenth day after the operation. There remained for some time a subjective sensation of heat in the left lower limb especially. Wound dressed; the remaining (the upper) drainage-tube was removed. The last time the catheter was used was 5 p.m. this day, the patient passing urine afterwards about ten times in the twenty-four hours, and about four ounces on the average each time, the rare extremes being two ounces and eight ounces.

On the 23rd, *i. e.* fourteen days after the operation, the frequency of micturition had diminished to six times in the twenty-four hours, *i. e.* normal. The constant pain was very severe and at times became excruciating, in fact the patient thought it was worse than before the operation.

16th.—The spasms by this day had gradually become restricted to the left side and lower limb, except when very severe. The cerebro-spinal fluid continued to ooze in considerable quantity through the small track of the upper drainage-tube.

22nd.—The patient steadily improved, the appetite returning, &c. This day he for the first time distinctly moved the right lower limb at the hip by "voluntary effort." On this occasion and also when (see below) the patient moved his left lower limb for the first time, he regarded the movement as only a spasm and not purposive, the muscular sense from disuse (?) being apparently deficient. (I have noted the same phenomenon in a case recently under my care in

which release by trephining of pressure on the spinal cord restored movement in the paralysed limbs.) The recovery of power spread down the limb to the foot.

At this time, however, the pain was still excessively severe at times, but was more paroxysmal, which was regarded, and rightly, as a favorable change.

July 20th.—About this date motor power returned in the left lower limb in the same manner as in the right limb, *i. e.* from the hip downwards. It is impossible to fix the date of this recovery as it was suspected for several days before the 20th, but the effort or initial spasm marred the observation, no aid forthcoming from the patient's sensations for the reason given above.

Further, the flow of cerebro-spinal fluid gradually diminished and ceased about six weeks after the operation. The arrest was aided by pressure with a pad of gauze and boracic acid over the sinus opening.

In this state, *i. e.* with recovered control of bladder and rectum, and with motion and sensation in the paralysed limbs, the patient was sent to the seaside on August 13th, 1887. The pain had gradually diminished and was confined to the left side.

A jacket consisting of a steel pelvic band from which shoulder crutches took origin, was applied to prevent possible kyphosis and to protect the cicatrix.¹

Nov. 17th.—In answer to queries the patient wrote on this date, "I think I am making good progress. I take a daily turn in the garden with the aid of a couple of sticks, and also a daily drive for an hour. My back and legs are still very weak and at night I suffer a good bit of pain² and my sleep is broken, but I am in all respects much better. Though I walk with difficulty the movement of my legs is natural and tends to get better every day." At this time as from the end of July the legs were passively moved and rubbed.

¹ The state of the cicatrix is shown in Plate III.

² The pain was always worse at night, and for some time before it disappeared had but very rarely occurred in the day.

Jan. 24th, 1888.—This day the patient kindly allowed the members of the Society to inspect his back, &c. The only important point noticeable now in his condition was the character of the gait, which resembled that of a man rather stiff from fatigue. He could walk three miles with ease. The scar was very firm and indeed of almost bony hardness in the site of the fifth dorsal spine and arch. The patient was practically quite free from pain and discomfort and had very greatly increased in weight and muscular development.

Feb. 21st.—Seen again to-day; the patient's rapid progress continues, the gait is notably more free and natural than when last noted. Patient about to resume his professional work.

June 6th.—Letter received this day from patient states that he is in excellent health, of which the best evidence is that he recently did a sixteen hours day's work, including much standing and walking about.

Remarks.—This being the first case in which a tumour involving the spinal cord has been exposed and removed, it is very advisable that a full explanation should be given of the reasons which led to the adoption of the surgical procedure above described, and I think at the same time it is worth while to look back over the literature on the subject of tumours of the membranes of the spinal cord, and to see what light may thereby be thrown on this subject.

Method of Operating.

The operation of trephining the spine has been of course known to surgery since it was suggested by Heister. It has, however, hitherto been discussed with reference to cases of injuries of the spinal column.¹

¹ It may be interesting here to reproduce Heister's suggestion. He says ('General System of Surgery,' 6th edit., 1757, p. 140), "But to offer the patient no assistance because we despair would seem cruel and uncharitable, therefore we must try our skill though our attempts should be in vain; in

Since it was suggested, this operation has been performed, according to 'Erichsen's Surgery,' about thirty times. Before discussing its employment in these cases it must be stated that ever since it was proposed this operation has met with the greatest opposition from some surgeons for various reasons, principally no doubt because it was performed first in the prescientific epoch of surgery, *i. e.* before the introduction of antiseptic principles by Sir Joseph Lister, and consequently it obtained much of its evil reputation from the frequency with which septic infection followed the exposure of the dura mater and the subdural space. But it has also been discarded by some on account apparently of difficulties, &c., in its performance, and in fact it is regarded by some as a very difficult as well as dangerous operation. For instance, Mr. Herbert Page, in Heath's 'Directory of Surgery,' page 134, 1881, referring to the treatment of fractures of the spine, says, "The operation of trephining the spine, proposed many years ago and adopted several times, has made no progress in surgery, nor is it likely to do so It is an operation not within the range of practical surgery." In expressing this opinion Mr. Page has no doubt been influenced by the difficulties and dangers before referred to, but I would submit that they have no real existence.

Mr. Erichsen, in the last edition of his 'Surgery,' says, "The operation is not necessarily dangerous, it does not appear often to have hastened death, and has certainly in some cases afforded relief." With regard to the latter point I will discuss that when reviewing the cases I have succeeded in collecting, and I think a description of the mode of operating that I have adopted will show more briefly than anything else the way in which many of the so-called objections to the operation may be removed. In the first place the operation has been generally objected to on account of:

order to which the surgeon must lay bare the fractured vertebræ with a scalpel and replace or else remove such fragments as injured the spinal marrow."

1. Hæmorrhage.
2. Difficulty in clearing the neural canal.
3. Physical difficulties of treating the fractured vertebræ.
4. The hopeless nature of the damage of the spinal cord.
5. Septic infection.

Of these objections we may with advantage consider Nos. 1, 2, and 3 together. In the course of some experiments upon the spinal cord, which are fully detailed in 'Brain,' vol. ix, 1886, I found that the mode of operating upon the spine for complete exposure of the bones as given in the text-books, namely, by removing the muscles from the bones by means of a blunt instrument, so far from being the best means for preventing hæmorrhage, is the easiest way of producing it. The knife must be freely and rapidly used while the soft parts are strongly retracted. It must be noted here that in every case I have found it necessary to divide the deep fascia, not only along the spinous processes, but also at right angles opposite the middle of the incision in order to prevent it resisting proper separation of the sides of the wound, indeed, it may in some extreme cases be found necessary to divide the vertebral aponeurosis at more places than one. It need hardly be added that this division of the fascia has no influence upon the rapid healing of the wound. The free bleeding which follows the separation of the muscles from the bone is best met by seizing what bleeding points can be seen with Wells's forceps and then tightly and quickly packing the incision on one side of the spine with dry sponges while the operation is proceeded with elsewhere. In this way very free oozing may be arrested in a few minutes, and the time spent in waiting for it to stop is certainly not lost, because the subsequent division of the bones can only be properly carried out when the wound is perfectly dry, as it is when the above-mentioned method has been followed. The periosteum is best reflected, without impairing its vitality, by scraping the bones with a suitably curved elevator after the mass of muscle has been turned aside.

Next with regard to the removal of the laminæ of the

vertebræ. If, of course, there is a fracture of the laminæ or of the spine it will be detected at once by seizing the bones individually in strong forceps and shaking them (Erichsen), the fragment being easily extracted by dividing with a knife the ligamentous attachment, and no damage will be done to any important part if the edge be directed towards the bone. If now, however, the spine be perfectly uninjured, as in the foregoing case, it becomes a matter of great interest as to how we may most quickly remove the bones. From numerous experiments on dogs I have adopted the following method: The spinous processes of the vertebræ whose laminæ are to be removed are cut through close to their base by very powerful bone forceps. This is readily done in a few seconds and we then have the laminæ forming a continuous if irregular plate, and this can be perforated with a trephine with the usual precautions. The trephine should be almost as large as the diameter of the neural canal, this of course varying with the region operated on, the age of the patient, &c. If more than one arch is to be removed it will be better, by means of an angular saw, to partly cut through the laminæ along the lines of the sides of the neural canal, and then the division of the bones can be completed with a bone forceps.

As in all these cases the wound cavity is necessarily deep, its walls steep, and relatively very unyielding, I have devised a form of bone forceps suitable for this stage of the operation. They simply consist of two ordinary bone forceps cutting blades set at an angle of about 120° to two short arms, which meet at the hinge and which are continuous with the ordinary long handles, the whole being bent at the hinge in a sharp curve, so that they can be employed to cut horizontally at the bottom of the cavity. More difficult than the incision of the bone is the removal of the ligamenta subflava. These can only be quickly and safely got rid of by steadily cutting with a sharp knife. After removal of the bone, as is well known, we find the dura mater covered with very vascular fat of a peculiar nature. This fat and loose connective tissue, if not treated

in the way about to be described, may be very troublesome indeed in causing free oozing of blood, and at the same time owing to its elasticity in obscuring the proper view of the dura mater. The numerous vessels supplying it of course come from the spinal arteries and the vertebral plexus of veins. Consequently, these are best avoided by keeping the incision in the fat strictly to the middle line. When this is done there will be very little bleeding at all, but at the same time the dura mater is completely covered by the fat. It can, however, be practically completely got rid of from the field of operation if it be retracted with broad retractors, and pressed against the sides of the neural canal for a few minutes or seconds while the dura mater is opened. This fatty tissue being very spongy seems to shrink under the pressure and remains practically out of sight during the remainder of the operation.

The next point to be considered is the treatment of the dura mater, &c. The dura mater, if opened in the middle line, will be found to admit of quite sufficient retraction to either side to expose the whole spinal cord and the subdural space. If of course the longitudinal incision in it be very short, say less than half an inch, it will be necessary to make a transverse incision as well in order to expose the whole breadth of the subdural region. But, as in the present instance, if incision be at all long, it is quite sufficient to restrict it to the middle line.

The next practical point is the escape of the cerebral fluid since on the first opening of the dura mater the cerebro-spinal fluid wells up very freely indeed, fills the wound and prevents anything like accurate handling of the spinal cord. The best course to pursue is to keep mopping it out of the wound cavity with a sponge so long as it flows. If the patient be not moved and if the spine be horizontal and the head not raised, the flow of fluid will soon cease, and the spinal cord then becomes freely visible. After inspection the spinal cord should be examined very gently by palpation, it being pressed against the bodies of the vertebræ in front, so as to reveal any change in its density. If

it be suspected that some fragments of bone or a new growth may be pressing against the anterior surface of the cord from one of the vertebræ, it can best be detected by carefully passing an aneurism needle around the side of the cord, and exploring this aspect of it. In mentioning of course the opening of the dura mater, the escape of fluid, &c., due care will be taken to notice in the first place whether the dura mater is of normal appearance and whether there is any indication of its being inflamed or distended. It need hardly be stated here that of course if there is hæmorrhage beneath it it will appear dark, if pus yellow, &c. In cases where the theca is pressed backwards against the laminal arches, either from old traumatism or caries, &c., great care must be taken in perforating the laminae with the trephine, but still more in raising the bone from the theca, for in such cases the dura is adherent to the anterior surface of the laminae by firm fibrous adhesions, these requiring division with the knife.

A more difficult question, and one which requires experimental investigation at the present time, is the problem under what circumstances it is advisable to suture the incision in the dura mater or to leave it open. In the foregoing case, although the incision was relatively of very great extent, it was left open, but there can be little doubt that the union of the wound at the bottom of the uppermost drainage-tube canal would have been much more rapid if the dura mater had been even imperfectly closed by fine sutures.¹ There is another point which seems to me to be of practical interest, even if its existence be only theoretical. This is the possible cicatricial adhesion of the floor of the wound to the posterior surface of the dura and cord, and to the posterior roots of the nerves entering the same.

It has been long known to physiologists since the researches of Schiff in 1851, that the posterior columns of the cord are conductors of painful impressions, and this can be demonstrated on an animal which is completely

¹ I have since sutured it with success.

narcotised with ether, so as to prevent the appreciation of pain, in the following manner. If in such an animal the various columns of the spinal cord be successively touched with a sharp point or other mechanical irritant, no reflex, *i. e.* involuntary, movements will result, except when the posterior columns are touched. This fact, as well as another mentioned below, is worthy of notice, inasmuch as it makes a high degree of narcotisation necessary for the performance of the operation under the best possible conditions. The other fact I now refer to is the sensibility of the dura mater. It is not apparently generally known that the spinal dura mater is an exceedingly sensitive membrane. In the dog this is particularly noticeable, and even in an animal perfectly narcotised with ether, reflex movements will occasionally occur when this membrane, like the posterior columns of the spinal cord, is mechanically irritated. It is very necessary, therefore, that when the dura mater is about to be seized in forceps with the view of opening it, or when similarly any delicate incision is to be made in it or into the neighbourhood of the posterior column of the cord, that the patient should be very deeply under the influence of the anæsthetic to prevent any unconscious reflex start, which might lead to very unfortunate results.

To return, it will be readily understood now that possibly as before stated the wide cicatrisation together of the floor of the wound, the dura mater and the posterior roots of the nerves might produce adhesion which would cause pain if the spine were freely moved. This, however, after all may be purely imaginary since in the present case, where all these conditions must exist, the pain which occurred after the operation was not attributable to this condition, since in the first place it was merely a continuation of that which the patient endured before the operation and moreover has now disappeared.

4. *The hopeless nature of the damage of the spinal cord.*

The consideration of this part of the subject is important

of course only in those instances where the cord is diagnosed to be completely softened or where the operation is undertaken for the purpose of relieving the results of fracture of the spine, the whole bearing of which we may very properly now consider. I am the more anxious to do so since I can make my meaning clearer by referring to a case of Dr. Buzzard's, in which I performed the operation last summer. The patient had fallen down a quarry and was sent up from Derbyshire to the National Hospital for the Paralysed and Epileptic in a very critical condition. There was absolute paraplegia as regards movement and sensation together with complete loss of control over the bladder and rectum. The urine was already alkaline and contained muco-pus. But the worst feature in the case was the existence of very severe and acute decubitus. Thus there was a large spreading sore over the whole breadth of the sacrum, extending especially deeply on the left side, sores over both heels, and a bleb on the left thigh.

It was very clear indeed to Dr. Buzzard and myself that unless the man was relieved from the most urgent symptoms he must speedily die. Examination of the spine showed that the spinous process of the eleventh dorsal vertebra was apparently broader than natural and a little more prominent, and at the same time very distinctly tender, in addition to which the patient very distinctly referred to this region as being the source of his weakness.

It was therefore decided to explore the seat of the fracture and if possible to remove any portion of the bone which might be pressing upon the spinal cord. The patient being placed in a prone position, and anæsthetised with chloroform, a longitudinal incision was made over the prominent vertebra. The soft parts, as before detailed, reflected, and then on grasping the spine of the eleventh dorsal vertebra it was found to be movable, but jammed forwards between the vertebræ above and below it. It was therefore seized in lion forceps and removed by cutting all the ligamentous bands attached to it. When it was extracted it was evident that the posterior surface of the dura-matral sheath

was pressed backwards against the laminæ of the tenth vertebra. This therefore was also removed. The dura mater appeared perfectly normal. The theca therefore was not opened posteriorly, but on exploring its anterior surface and the bodies of the vertebræ with an aneurism needle a small puncture was made into it from which there escaped perfectly normal cerebro-spinal fluid. There was no evidence of any previous severe compression of the dura mater or its contents, and no evidence of hæmorrhage into the same. The wound was therefore closed and a drainage-tube placed opposite its middle; it was dressed strictly antiseptically. The further progress of the case was one of much interest; although the operation made no difference whatever in the motor paralysis and only slightly improved the sensory paralysis, it completely arrested the acute decubitus, the sores ultimately healing firmly, and what is still more interesting, from the time of the operation the urine became acid.

The drainage-tube was removed on the second day and the wound was completely healed at the end of seven days without a trace of suppuration.

In this case no doubt the spinal cord was momentarily jammed at the time of the accident so severely as to practically, *i. e.* functionally divide it. Though laminæ were found compressing it at the time of operation, nevertheless they did not do so so severely as to thereby alone cause the excessive degree of the symptoms, therefore it would seem that the cord, as suggested, must have been compressed at the time of the accident. Now, this is just a case in which if any attention had been paid to the ruling before quoted, the patient's life would have been lost, and indeed it must be obvious that, considering the necessarily small amount of information on this subject, it should be our duty to operate in every case, since we may possibly do some good, and certainly, if proper antiseptic precautions be taken, we can, to use Mr. Erichsen's words, do no harm. This question of the damage to the spinal cord not appearing to discount the possible benefit of surgical interference so much as has been

hitherto expected, gains additional illustration from the case which forms the subject of this paper, since nothing could well have appeared more hopeless than the indentation of the spinal cord produced by the tumour. This indentation appeared to divide the lateral column completely, and yet, owing doubtless to the gradual character of the compression, the restoration of motor and sensory function has been complete. I would repeat therefore that, so far from its being unjustifiable to operate on the spine owing to the possibility of the cord being hopelessly damaged, it seems to me to be criminal not to operate.¹

5. *Septic infection.*

The possibility of septic infection following this operative procedure is of course exactly the same as that which attends any surgical interference, and needs only to be guarded against in precisely the same way, namely, by the Listerian principles of antiseptic surgery. No special liability to septic infection attends wounds in the region of the vertebræ, though of course the subdural space is undoubtedly an unusually favorable nidus for the organisms of putrefaction. As, however, I have repeatedly urged in discussing the surgery of the cranial cavity, this danger can be removed by the use of powerful disinfectants in a strong solution, *e. g.* 5 per cent. carbolic acid solution, &c., by irrigation of the wound during the operation, and this irrigation is afforded with the least inconvenience by the spray. The drainage of the wound is so extremely easy since the patient usually lies supine, that it can be completely provided for by a drainage-tube kept in for not more than forty-eight hours.

Summing up therefore, I think I have shown reason for regarding the operation of trephining the spine as a comparatively easy one, safe and justifiable, and that its reputed dangers are no more than those incidental to all wounds,

¹ Since this was written I have trephined the spine in two more instances, in both the wound healing without any complication whatever; one, a fracture: the other a case of complete paralysis of all four limbs, &c., from severe caries of the second and third cervical vertebræ is now rapidly regaining power, being able to move both legs on the eighth day after operation, and the upper limbs later.

the only peculiarity being the fact that septic meningitis is practically a fatal accident, the avoidance of which, however, is well understood and provided for in 999 cases out of 1000.

We will therefore pass on to the review of the similar cases collected in the accompanying table.

Tumours of the membranes of the spinal cord.—I have been able, by referring to text-books and journals, to find accounts of fifty-eight cases, which I have arranged in the following table, which does not pretend to be exhaustive but I hope is sufficiently illustrative of the subject to warrant the conclusions which terminate this communication.

In this Table the facts relative to each case, so far as they have been recorded, I have arranged under headings which seemed to indicate the salient points upon which our future information must necessarily be full to admit of our making a correct diagnosis. Unfortunately, as will be seen, even the most fully recorded cases do not admit of close contrast one with another, owing in the vast majority of instances to the fact that their real nature was wholly unforeseen. Hence it may be well at some future time to draw attention to one or two points in comparative diagnosis, which need a more complete elucidation than is apparently forthcoming from the clinical records at our disposal. Especially is this required for cases where the active source of pressure is a parasitic cyst, and which, therefore, can only be treated by surgical operation. A collection of such cases has recently been made by Dr. Maguire, to whose paper in 'Brain,' January, 1888, p. 451, reference must be made for details, but I have inserted a few cases in the table by way of comparison.

The special want of information will be seen at once in the summary of the facts detailed in the Table, and in the history of the case, the subject of this paper.

The summary of the facts in the Table will be best arranged in the order of the headings to each column as follows :

Column 2. a. Age.

Among the preliminary facts, the age of the patient, the subject of any of the diseases included in the table, is of course an important matter, since it will give aid sometimes in the diagnosis of the nature of the growth.

A.—EXTRADURAL GROWTHS.

1. *Lipoma*.—It is interesting to note that in the four cases of lipoma the extremes of the ages were 10 months and 4 years respectively, the average being $2\frac{1}{2}$ years. Since the nearest approach to this age is to be found under the heading of intradural tubercle (see below), it is evident that if we have presented to us a patient of such an early age with symptoms of compression of the spinal cord, the assumption that the growth is lipoma will be very strong indeed. For further discussion of this important point see 'Nature of the Growth,' Column 24.

2. *Sarcoma*.—The kind of tumour which occurs next in the order of age is sarcoma, the average age of the patients being 18 years.

3. *Echinococcus*.—Next to this sarcoma is echinococcus (of course almost invariably extradural in any case), which attacks patients of an average age of 34 years (possibly less).

4. *Tubercle*.—It is interesting to find that tubercular mischief outside the spine causing fatal compression of the cord, apparently occurs in patients of an average age of 39 years. I say apparently because the fatal cases are not numerous, whereas of course we frequently see non-fatal instances of pressure of the cord from extradural tubercular disease, usually spinal caries, in children.

The foregoing are the commonest forms of extradural disease. The rarer, such as scirrhus or myxoma, occur beyond middle life, at 48 and 53 years in the table, as of course would be anticipated.

B. INTRADURAL GROWTHS.

1. *Myxoma*.—Included under this heading are pure myxoma, myxomata in which there is a considerable amount of fibrous tissue, and which therefore might by some be considered worthy to be put into a separate class entitled *Myxofibroma*, and lastly cases¹ in which no diagnosis is given, but which, nevertheless, from the description, are evidently of a similar nature. Under any circumstances the cases of undoubted myxoma outnumber the instances of any other kind of intradural growth. In a total of eleven cases the extremes of ages were 19 and 60 respectively, the resultant average being just over 43 years of age.

2. *Fibroma*.—At almost exactly the same age as myxoma, fibroma occurs; thus the average of the six cases was 44 years.

3. *Sarcoma*.—Similarly, sarcoma is noted to occur at the average age of 41 years.

4. *Psammoma*.—Contrasted with the foregoing tumours of youth and middle life on the average is psammoma. This growth, which has been recognised for many years as epitheliomatous, it is instructive to see occurs at an average age of 51 years. This is in harmony with the general facts recorded of the ages at which any of these neoplasms are likely to arise.

5. *Tubercle*.—One disease alone remains for special notice, namely, tubercle, which in its intradural form was found present on an average at the age of 18·5 years. Reference to the extradural form will show that that occurred most commonly at 39 years, due reservation being made as already stated. For general purposes, however, we may conclude that if we have evidence of an intradural growth in a person beyond 30 years of age, it is almost certainly not tubercle.

¹ As will be pointed out later, it seems likely that the results of traumatic hæmorrhage are included in this class.

Column 2. b. Sex.

Of the total number of fifty-seven cases the sex is recorded in fifty-four, of which twenty-four were males and thirty females.

The preponderance of the female sex is the attribute of the intradural growths as contrasted with the extradural. Thus, in the former class of thirty-six cases fourteen were male and twenty-two female, while of the latter class of eighteen cases ten were male and eight female.

Why the female sex should more especially suffer is not easy to see. If the views expressed further respecting traumatism are correct, then the difficulty will be in a measure removed, for in the course of parturition we have an obvious source of intraspinal traumatic lesion.

This subject, however interesting, scarcely in our present knowledge admits of further profitable discussion; we will therefore pass on to consider the next point, viz. the alleged cause of the disease in each case.

Column 3. Alleged Cause.

The discovery of a cause of the appearance of a new growth is in most cases a matter of considerable difficulty, and the origin of intraspinal mischief especially. It will, however, appear that some forms of new growth, either without or within the theca, do in their minute structure clearly suggest their mode of origin and source.

A. EXTRADURAL GROWTHS.

1. *Lipoma*.—In three of the four cases in the Table the fourth case probably supplies the clue, viz. congenital abnormality. The fat, which normally occupies much of the space between the theca and the neural canal, is highly vascular, and can easily be understood to occasionally take on a hypertrophic condition, which would lead to the fatal issue.

2. *Sarcoma*.—In three of the five cases to which a cause is assigned, we find it asserted to have been respectively “fall on the back,” “exposure to cold,” and secondary to primary disease elsewhere. I will return to the two former of these in summing up.

The causation of the remaining diseases does not call for special notice, owing to their pathology being known, with the exception of fibro-chondro-lipoma, in which again exposure to cold is alleged as the probable cause of the origin of the tumour.

B. INTRADURAL GROWTHS.

1. *Myxoma*.—Of the eleven instances of this tumour, cause is assigned in seven cases as follows :

Traumatism	2 cases.
Exposure to cold	2 cases.
Parturition	1 case.
Suppression of menses	1 case.
Fright	1 case.

Possibly we should associate the third alleged cause with the first, and the fourth with the second.

2. *Fibroma*.—Of seven cases in which cause is alleged it is described as follows :

Exposure to cold	3 cases.
Traumatism	2 cases.
Chlorosis	1 case.
Fatigue	1 case.

3. *Sarcoma*.—For this growth we find :

Exposure to cold	2 cases.
Traumatism	1 case.
Fit of anger	1 case.

4. *Psammoma*.—Cause given only once. Stated to have come on soon after parturition. ? Traumatism.

The other intradural conditions, such as tubercle, parasites, &c., require no description.

On addition of all the alleged causes of both extra- and intradural growths we find them to stand as follows :

Exposure to cold	8 cases.
Traumatism	8 cases.
Mental shock	2 cases.
Chlorosis	1 case.
Fatigue	1 case.
Congenital	1 ? 4.

Considering that these alleged causes are given for only thirty-five¹ instances of disease, it is very remarkable that in almost one half of the total number of the cases thus recorded the cause should either be attributed to traumatism or exposure to cold, and this fact is of course greatly strengthened by consideration of the whole number of twenty-one alleged causes no less than sixteen are ascribed to these excitants. To this must be added certain facts from the histories of the cases, which are but briefly alluded to in the Tables. Thus, in several instances of the traumatism and in many instances of exposure to cold, the leading and earliest symptom, *i. e.* pain, was noted to commence directly after the sufferance of the alleged cause. But more than that. We have, I think, direct evidence on this point of a more valuable kind, viz. that afforded by anatomical investigation, whilst if from the table we extract the eight cases of traumatic origin, we shall find that three must be put aside because the tumour was solid, or because not sufficient facts were known about it to enable us to express an opinion bearing upon the question at issue. Of the remaining five, in two the symptoms were observed to follow directly upon the injury, so there is no question as to the real relation existing in them between the supposed cause and effect. These two cases are Nos. 24 and 44, and though classified according to the diagnosis as myxoma and fibroma respectively they are indubitably cystic formations so commonly set up by traumatic hæmorrhages in the membranes of the central nervous system. The records make this point perfectly clear, especially in Case 44, where the altered blood pigment is clearly described.

¹ The origin of the remaining twenty-three being known, *e. g.* tubercle, &c.

Passing now to Cases 46 and 32. In each I have had the opportunity of microscopically investigating the growth very thoroughly, and in each I have found scattered through the whole growth numerous collections of hæmatoidin granules, in many cases enclosed in corpuscles, as is so frequently seen in the neighbourhood of old extravasations of blood. At the same time there were no evidences whatever of recent hæmorrhages into the tumour substance such as occur in myxomata. Case 28, also classified as myxoma from its remarkable identity with 32, I strongly suspect to be due to the same morbid process, and this notion gains weight from the history of the case.

HISTORY.

Column 4. Personal.

The personal history in such a heterogeneous mass of cases has little value. It is only of somewhat painful interest to note that in almost all instances of these invariable fatal cases, the patient was in perfect health before the commencement of the symptoms and nevertheless was condemned to an extremely painful and lingering death, although as a rule the mischief could have been readily removed by surgical interference.

Column 5. Family.

In the same way there are no facts of noteworthy value to be drawn from the records of the family history.

Column 6. Total duration of Symptoms.

Extradural growth—

Lipoma . . .	Average about $1\frac{1}{3}$ years.
Sarcoma . . .	„ 9 months.
Echinococcus . . .	„ 6 months.
Tubercle . . .	„ $1\frac{1}{2}$ years.
Scirrhus . . .	„ $1\frac{1}{2}$ years.
<hr/>	
	5 yrs. 7 mos.

General average about 1 year, 1 month.

Intradural growth—

Myxoma . . .	Average $4\frac{1}{4}$ years.
Fibroma . . .	„ $3\frac{1}{2}$ years.
Sarcoma . . .	„ 2 years.
Psammoma . . .	„ $3\frac{1}{3}$ years
Tubercle . . .	„ 8 months
Parasitic cysts . . .	„ (?) 9 months
<hr/>	
14 yrs. 6 mos.	

General average about 2 years 5 months.

From these figures it is evident how much more chronic are the symptoms when the mischief is within the theca than when outside it. Doubtless this is simply owing to the prevalence of the simpler forms of neoplasm among those growing from the spinal membranes. To whatever cause it may be due the fact is important in assisting the probable diagnosis.

Column 7. Course of Symptoms.

Nothing obviously is of more importance than the special manner in which the symptoms are gradually developed. Unlike those occasional instances in which a cerebral tumour suddenly produces pressure symptoms, the spinal cord tumour seems practically never¹ to initiate such a condition. The only noteworthy exceptions being for the most part parasitic cysts which sometimes owing to the hydrostatic conditions under which they exist, suddenly enter the neural canal in some position of flexion of the spine. See Case 16.

Review of the whole number of cases, regarding them all as simple instances of mechanical pressure on the cord, is perfectly justifiable for the correct estimation of the relative sequence of a few symptoms, the remainder being considered in their development under their special headings in Columns 8 to 20.

¹ Sir B. Brodie in the 'Lancet,' pp. 378, 379, gives a case in which an intramedullary growth produced sudden paraplegia.

Column 8. I. Extradural Growths.

Of seventeen cases belonging to this class in which the course and development of the symptoms was fairly recorded, the first symptom was pain in seven cases, motor paralysis in six, the two combined in one case, motor and sensory paralysis combined in another, and finally muscular spasm in one case. Most frequently in the subsequent development of the chain of symptoms, sensory paralysis came later than motor, frequently the patient noticed the two to be developed simultaneously. Altogether twitchings of the muscles were recorded historically in but three cases see, however, Column 12.

The symptoms as a rule indicated diffuse pressure within the neural canal, for in only five¹ was there an approach to transfer of symptoms from one side to the other (right to left in three cases left to right in two). It is proper to add, however, that in four other cases the symptoms showed a tendency to be most marked on one side (the right in four cases the left in one).

Summing up we have thus ten cases in the seventeen in which there was an incomplete unilateral character in the symptoms.

However, the most important point in the development of the symptoms is of course the march, and in this extradural division of the cases it is clear that the commonest march would be **Pain, Motor paralysis, Sensory paralysis**. It being very distinctly understood that it is common in this condition to have the motor and sensory paralyses in close combination both in degree, relatively speaking, of course, and in time.

II. Intradural Growths.

In contrast to the comparatively frequent occurrence of ill-defined arrangement of symptoms in the extradural growth,

¹ *i. e.* 29 per cent.

we have in the intradural a most remarkably constant march. Thus from a total of thirty-three available cases twenty-one begin within pain as the first symptom, four pain combined with motor paralysis as a first symptom, and but six with motor paralysis alone. The subsequent march is just as striking, the loss of motor power preceding sensory paralysis in the very large majority of cases, indeed only in four instances out of the total of thirty-three did sensory paralysis precede motor. Therefore the march is easy to write in these intradural cases, being **Pain, Motor paralysis, Sensory paralysis.**

Of greater interest, and for diagnostic purposes of greater value, are the facts relating to the transference of the symptoms from one side of the body to the other, the possibility of localisation of the growth being thereby of course greatly increased.

Careful observation of such cases (as, for example, No. 50) indeed reveals, in some instances, pathological effects such as make the condition tantamount to hemisection of the cord, so that we have reproduced clinically the classical experiment of Brown-Séquard. But in the majority of cases we have to derive our information from the unskilled observation of the patient or the friends, so that at the most we learn that transference did occur. The transference in this division of the cases is very different to that in the extradural, inasmuch as in this variety the interval between the invasion of the limbs successively affected is usually weeks and occasionally months.

Of the thirty-three cases such marked transference was noted in sixteen cases, *i. e.* 48 per cent., which is a great advance upon the 29 per cent. of the extradural growths. Of these sixteen cases in nine instances the transfer was from the left to the right, in seven from right to left.

Grouping both divisions of the case together we find that as soon as the paralytic symptoms are well developed, the pain (for fuller details of which see the discussion of the next column) becomes horribly exaggerated, then decubitus occurs, and later the patient dies pyæmic or uræmic, by

septic absorption from the bedsores or from the decomposition of the urine.

Column 9. Pain.

From the time of Cruveilhier the pain accompanying the development of intraspinal tumours has been reckoned with paralysis to be the most noteworthy symptom in the affection. Its course is almost always insidious, excessively rarely is it sudden in its onset, being then obviously owing to hæmorrhage or rupture of a cyst. At the first and indeed throughout the course of these cases they have almost invariably been diagnosed as rheumatism; consequently it behoves us to examine closely into its character to see whether there are not features peculiar to it which should prevent such a melancholy mistake in the future. We will therefore go through the records of the pain in the tabulated cases from this standpoint.

First we note the immensely important fact that however severe the pain may be it is never referred to any part above the seat of the lesion. To this there seems no exception. Besides Case 32 there are several which show this most strikingly. While thus the symptom is never placed above the lesion it is only localised below the lesion, a matter of extreme import to the operator in search of a tumour, &c.

If possible it would be most interesting to determine exactly the localisation of the pain as contrasted with the actual position of the tumour, because we should thus have, owing to the constancy of pain as a symptom, a powerful addition to the array of diagnostic guides. Although the records at our disposal are unfortunately greatly wanting in this respect, those cases which do point to some conclusion on this question had better now be referred to in a little detail.

Case 7. In this case the growth was situate from the sixth to the eighth dorsal vertebræ, *i. e.* bodies. The pain was referred to the distribution of the ninth dorsal nerve. Simi-

larly in Case 32 the growth was opposite the third dorsal vertebra (body), the pain being distributed in the area supplied by the fifth nerve. In these two instances the difference between the position of the growth and the localisation of the pain was clearly due to the anatomical relations of the nerve-organs and roots to the vertebræ, and something more, viz. the as yet (in the human being) imperfectly known course of the fibres in the spinal cord. Thus in Case 32, as is stated in the history of the operation &c., the growth was diagnosed to be opposite the highest root of the fifth nerve, *i. e.* localising it by means of the pain and anesthesia, but as a matter of fact the tumour was situated four inches above the zone of anæsthesia. It is possible that the actual pressure of the growth upon the cord produces much less effect on the intramedullary fibres than one would expect, and this would seem to explain why the ascent of the distribution of anæsthesia to the level of the lesion is so very long in completely developing. Extreme cases are those in which, as in Cases 11 and 13, extradural pressure, the lowest point of which was the third dorsal vertebra in the one case and the fourth dorsal vertebra in the other, produces pain referred to the lower limbs. The other extreme, viz. perfect localisation by means of the nerve, is to be seen in Case 28, where invasion of the fifth dorsal root upon which the tumour was sessile caused severe pain in the corresponding intercostal space. Probably also Case 46 is of a like character, an example of intermediate cases for which no explanation appears forthcoming save such as I have suggested in No. 41, where we have the pain for a long while referred to the distribution of the ulnar nerve most particularly, although the growth did not descend lower than the fifth cervical vertebra, the ulnar nerve of course deriving most of its fibres from the eighth cervical and the first dorsal. In this last case there were certain vague pains felt in the neck and shoulder, which of course might certainly be taken as suggesting possible affection of the cervical nerves as high as the fifth, but these were evidently insignificant compared

to the localisation of the pain to the distribution of the ulnar nerve. The only conclusions then that we can draw to guide us in this matter are, firstly, that if the pain be extremely well defined in the course of one nerve of one side then a lesion may be diagnosed to exist in the course of that nerve and so it may be localised with ease; secondly, that where there is no delimitation of the pain, but where the anæsthesia is apparently well marked and in accord with nerve-supply, it is necessary to be most cautious and to define if possible the upper border of the hyper- or paræsthetic zone which so usually surrounds the upper limit of the anæsthesia, but applying what has gone before, the proper course to follow will obviously be the exploration of the neural canal and its contents at the highest point that is suggested by any definite symptoms, and among such we should include even slight paræsthesia. Pain of a constant dull aching character seated in one fixed point in the spinal column is of course most valuable as indicating the focus of disease, but caution is requisite here again, and unless the limitation of the pain is very distinct it would be best to regard it as of slight value. If, though slight, it is accompanied by a symptom of which very little notice is taken, to judge by records, but one nevertheless of great value, namely, a sensation of weakness felt by the patient at that point in the spinal column, and if this sensation, which is of course subjective, be heightened by fatigue, then it assumes a leading position among the localising symptoms.

We may now proceed to consider¹ the character of the pain with regard to its diagnostic value. Noting usual forms first we must begin with the subjective sensation of burning, which occurred as frequently as in five out of the fifteen cases in which the pain was carefully described. In Case 32 this was extremely marked, the patient complaining that the whole of the left side and lower limb appeared to be red-hot and burning. In another patient the pain was described as roasting. This consequently

¹ In the intradural division only.

would appear to be an important fact to remember in dealing with painful conditions of the spine. The most frequent form of pain is that common to many affections, namely, shooting. In two instances it is described as pricking, in one as gnawing, and in one as stabbing, but little value attaches to solitary statements of this kind, especially as a full description is so seldom given. The next point is the relative amount of pain excited by the presence of the tumour. This, of course, is only to be correctly estimated in the intradural division of cases. Careful examination of the cases in which the pain is noted shows that even after eliminating possible errors it is a more prominent feature in those cases where the pressure is directed postero-anteriorly, and antero-posteriorly, than in those in which it is directed laterally. This is easy to understand in view of the fact that in the first two directions the pressure will directly influence the extremely sensitive posterior columns. The exceptions to this generalisation may be very striking, as, for instance, in Case 32.

It will not escape notice in the tables how almost invariably the pain in the lower limbs ascends from the soles of the feet in precisely the same manner as the anæsthesia is almost always subsequently developed.

Considering the extreme frequency of pain from tumours pressing on the spinal cord it is worth while glancing at those few instances in which pain is not recorded. In none of the cases of extradural lipoma is pain recorded. Probably this omission may be attributed in great part to the age of the patient, and has consequently been omitted from the records, but again it is not recorded in Cases 33, 35, 49, 57. Unfortunately these latter are just cases in which the notes are not so complete as could be wished, so that it would be hazardous to guess what the absence of record signifies. In view of the general obscurity of the subject, however, it is worth while to draw attention to the point.

Column 10. a. Paralysis of Motion.

Few things are more regrettable than the almost complete absence of record as to the mode in which the motor paralysis in these cases successively invades the various segments of the limb. So far as can be made out the advance of the paralysis is from above down. The patient in five cases of paralysis of the lower extremities was unable to stand before loss of the movements of the leg when lying down, and this form of early paresis was not necessarily accompanied by such sensory paralysis as produced ataxia. In one case of paralysis of the upper limb the result was different, the fingers being stated to be paralysed while the shoulder was only weakened. It is most desirable that this subject should be elucidated as soon as possible for the sake of prognosis as well as diagnosis, and all observations should be complete for each segment from the hip to the great toe, the representation of the latter being specially interesting.

b. Paralysis of Sensation.

The gradual abolition of sensibility appears in all cases to advance up the limbs from the soles of the feet. Here again the difference between the appreciation of various forms of sensory stimulation needs much careful examination in the future, and notably the contrast between pain, touch, and temperature (see Case 28).

Column 11. Reflexes.

In every case, without exception, if the cord were pressed upon, the reflexes both superficial and deep became greatly exaggerated. As the cord became completely destroyed

and descending degeneration and wasting marked, so the reflexes were gradually lost, the abolition beginning almost invariably with the plantar and passing upwards.

Column 12. Spasms with Clonus.

According to well-known facts, spasms and clonus (ankle and knee ?) were noted in the large majority (61 per cent.) of the intradural cases and in 35 per cent. of the extradural. It is noteworthy that among the latter they were only recorded as accompanying the development of lipoma and echinococcus cysts. The reason of this is not apparent.

The genesis of such spasms is slightly illustrated in the Table by but one case, No. 28, in which the spasms are noted as occurring on the same side as the tumour. Hence we may obtain, on further examination of future cases, evidence as to the direct effect of pressure in this connection.

It is worth mentioning that in one case in which the spasms were originally most severe they disappeared one month before death, *i. e.* when the cord became so disintegrated as no longer to react to the irritation.

Column 13. Rigidity.

Closely connected with the foregoing column is that of rigidity. Like spasm and clonus this is very much more frequent with intradural than extradural growths, the percentages of recorded occurrence being respectively 50 per cent. and 15 per cent. Consequently, there is good reason for supposing that the existence of marked rigidity is evidence of intradural mischief.

A point of interest now arises. In fourteen cases of intradural growth in which it was recorded, in eleven the attitude assumed by the contracted limb was that of flexion, in three that of extension. One case suggests a

cause of this difference. In one instance in which the tumour was found on the right side of the spinal cord the right lower limbs were the seat of spasm in flexion, whereas the left lower limb was in extension. It would seem as if the growth specially induced irritation effects according to the intensity of the pressure employed. Thus, in the initial stages of the "pressure myelitis" the spasms may be those of extension, while in the final condition flexion predominates. The same thing may be noticed in the pressure myelitis resulting from fracture, dislocation of the spine, &c.

Column 14. Decubitus.

The formation of bedsores is of course the rule, and these are noted almost invariably in the cases of intradural growths as being terribly extensive. In many instances the buttocks are deeply excavated as far as the trochanters. In two cases (Nos. 47 and 32) the bedsore was situated on the same side of the body as the tumour, just as cerebral decubitus is seen on the opposite side to the nerve lesion.

For the effects of the decubitus see p. 53.

Column 15. Nutrition.

The nutrition of the paralysed parts is variously described as affected. Thus, in a few instances the change is mentioned as local, twice in the extradural and five times in the intradural growths. There is of course wasting when the growth penetrates an intervertebral foramen and destroys a nerve-root, but the instances in which local wasting occurs, *e. g.* of one lower limb as in Cases Nos. 24, 41, when the pressure is general are very rare. In eleven cases of both kinds of growth the wasting is described as general, and it may be that this general emaciation has led to supposed observation of local atrophy.

As a rule the nutrition is not impaired unless the paralysis be complicated with pyæmia, &c.

Column 16. The Spine and its Physical Examination.

This is a very interesting point, but not one from which much can be learnt, for out of the thirty-one cases (in both groups) in which the examination was made, it is distinctly stated in thirteen that nothing could be discovered.

Putting aside the six cases (five extra- and one intradural) in which the problem of diagnosis was obviously solved by the presence of an external tumour solid or containing fluid, we may proceed to note one or two important facts, although the number of cases remaining at our disposal is only twelve.

A review of these shows that the alterations in the spine produced by an *intradural* growth are as follows :

1. Tenderness on percussion.
2. Stiffness and weakness.
3. Curvature usually lateral.

The relation of each of these to the seat of the tumour is the most valuable evidence they offer, and that is as follows.

Perhaps the correspondence or want of the same will best be shown in parallel columns. Thus :

Tenderness on pressure was felt at the	The tumour was situated at
Mid-dorsal region.	5th D. nerve.
10 D. V. and downward.	7 to 10 D. V.
1 to 4 C. V.	4 to 5 C. V.
5 to 7 C. V.	4 to 5 C. V.
1, 2, 3, 10 D. V.	2 to 3 D. Nerve.
7 C. V.	1 ? and 5 D. ?
6 D. V. (spinous process).	3 to 4 D. Nerve.

From this Table it appears that practically without exception a tumour occurring in the dorsal region is higher than the spot described as tender on pressure. In the cervical region this generalisation does not seem to hold so closely. It need hardly be pointed out that the inclination of the nerve-roots goes far to explain this, but the cases

are too few and unfortunately but too rarely recorded in precise detail to admit of laying more weight on this point.

If "stiffness" be present it will be found to closely correspond with the portion of the tumour.

Similarly, if "curvature of the spine" is observed it will be found to be a secondary result of the tonic spasm of the spinous muscles, and therefore the concavity of the bend is on the same side as the growth. Removal of the source of the spasm, as in Case 32, restores the line of the spine.

Column 17. The Pupils.

As a symptom of this class of cases, change in the size and activity of the pupils only occurs when the cord is pressed upon above the level of the second dorsal nerve. When this happens, as in Case 4, the dilator fibres are of course paralysed, and the pupil becomes smaller than that of the opposite side, and almost immobile.

Column 18. The Urine.

As a rule the urine becomes retained in the bladder as the paraplegia is gradually developed, and following such retention comes decomposition and then cystitis. The organism (*Streptococcus pyogenes*?) which sets up the cystitis gains access by the ureters to the kidneys, and there develops, causing interstitial nephritis, the usual direct cause of death in these cases. In but four cases is the urine recorded as normal, viz. extradural scirrhus, extradural tubercle, intradural fibroma *not causing paralysis of any kind*, intradural sarcoma in which rapid generalisation occurred.

It is curious to note that in the first two instances the lower limbs were œdematous. No change would be expected in the third case.

This is not the place to enter into any discussion as to the cause of the alkalinity of the retained urine and its

subsequent decomposition. Suffice it to say that, as proved on p. 27, the reaction does not depend on the introduction of the *Micrococcus urææ* from without.

In the scirrhus case polyuria occurred.

Column 19. Vaso-motor changes.

The changes which may be attributed to perverted vaso-motor action are of course summed up in the word swelling. This was noted but six times in the whole fifty-eight, consequently it cannot be looked upon as an important symptom. Neither, unfortunately, can one learn from the accounts of the case why it should have occurred even thus rarely.

Column 20. Vomiting

Was never present as a direct result of the cord mischief.

The circumstances which relate to the tumour must now be grouped together for consideration.

Column 21. Relation to the Dura Mater.

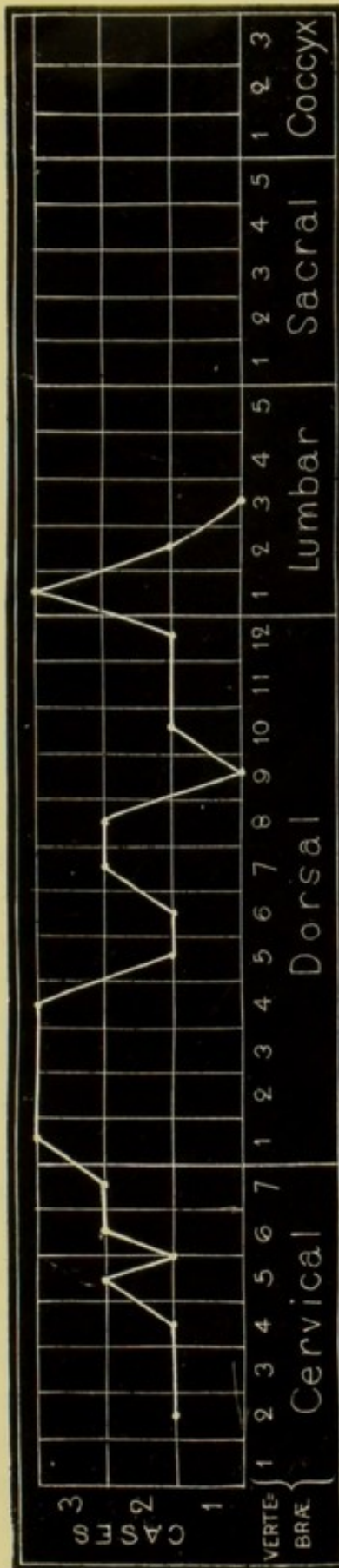
For every reason the relation of the growth to the dura is of the first importance. It has already been shown that we may thus separate tumours of different nature as being of practical certainty situated either inside or outside the theca. For the further bearings of this point on these cases reference must be made to the foregoing pages.

Column 22. Size.

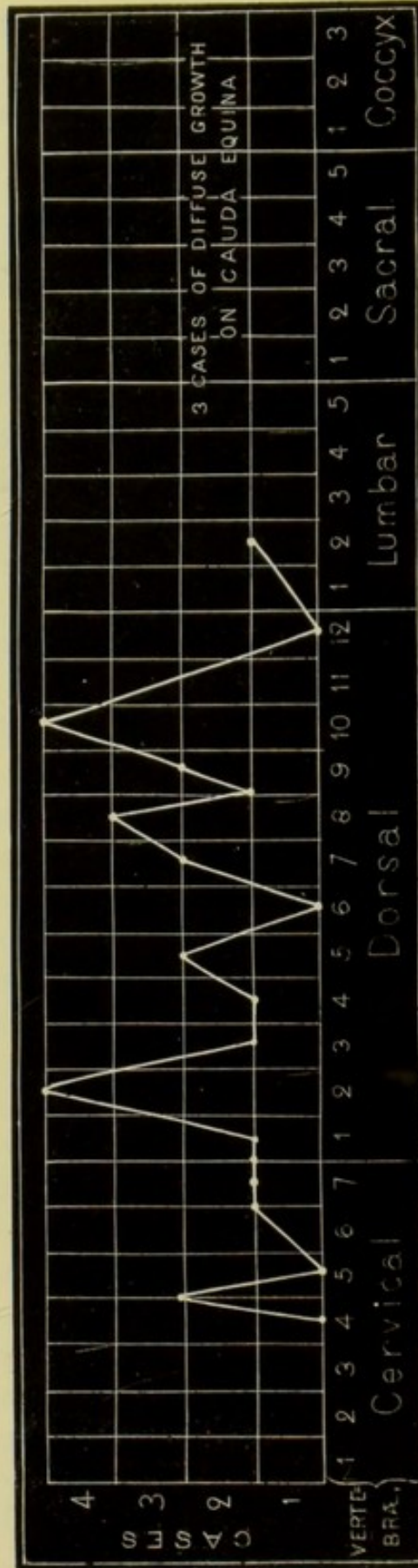
The size of the growth in any particular case is limited by the size of the theca, the amount of its lumen taken up by the cord, &c. As a rule the mass is oval or ellipsoidal,

Curves showing the Prevalence of Growths at different Points in the Spine.

I.—Extradural.



II.—Intradural



Note.—The curve in the extradural group is necessarily of much less value than No. II in that in individual cases in the upper dorsal region affected so many vertebrae as to prevent localisation.

the long axis being parallel to the middle line of the cord. A necessary result of the variable position of the growth is that tumours of the same size produce widely different effects, consequently the size *per se* has little bearing on the symptoms.

Column 23. Position.

There are several ways in which the position of the growth assumes importance, viz. :

1. In relation to the causation of the growth.
2. The relative effects of the growth. (a) According to its vertical position on the cord. (b) According to its horizontal position on the cord.

(a) On grouping all the cases in the Table together, it is at once obvious that most of the cases occur about the following points in the spine :

1. Just below the centre of the cervical region.
2. The upper end of the dorsal region.
3. The lower end of the dorsal region.

These regions are those in which there is least intrathecal spare space. Moreover, just as the cases increase in number from the cervical region downwards so the cord becomes less and less firmly fixed in the theca. Whether it is injudicious to regard all these facts as pointing to a traumatic¹ origin of the majority of the growths time alone will show. The cases in which there was good reason to suppose that direct injury was the exciting cause of the growth are not specially grouped around one of the above-mentioned regions, so that until we have before us the fuller and more accurate accounts of future cases we must leave undecided the bearings of the position of the growth.

It must be observed in passing that no one kind of growth is peculiar to any one region of the spinal column.

(b) The position of the growth in causing the production of definite symptoms, according as to whether it is on the anterior, posterior, or lateral columns, has already

¹ *E. g.* including direct injury, changes of temperature, &c.

been in great part described. But it remains to be mentioned that the *relative* rapidity of development of the pressure in these tumour cases seems to have prevented such minute analysis as is possible in pressure of the cord from caries of the spine producing curvature. Moreover, the diagnosis having usually been wrong, and attention having been concentrated on the pain, the initial stages have been so badly described as to make it impossible to place much trust on the accounts, as explanatory of the influence of position.

Column 24. Nature of the Growth.

The nature of the growths is set forth in the headings of each division of the table, and as far as possible the details of the structure of the tumour are supplied in each case. Leaving out the parasitic cysts, &c., the conclusion from the list of names is obvious, namely, that almost all these tumours are those of the simple connective-tissue type, and that they spring from the arachnoid, or more rarely, from the pia mater. With the debated origin of psammoma we have nothing to do here, but the epitheloid covering of the arachnoid sufficiently indicates its possible source. Although too, as before stated, some of the diagnoses of the real nature of the growths are uncertain, still, whatever the kind asserted, there is one characteristic common to all the localised intradural kind which is of the highest importance. This is the fact that they are almost invariably covered with a thin capsule (derived from the arachnoid?) and that their connection with the spinal cord is of the slightest. Consequently, they can be dissected from it without causing the slightest injury to a single nerve-fibre. In this connection reference may properly be made to the fact that since the tumours are as a rule of the simple connective-tissue type, extremely localised and slow growing (average duration of symptoms in intradural growths being about two and a half years, with the resul-

tant production of a small mass of tissue weighing a few drachms), recurrence after removal is not to be expected. In Case 32, the only one at our disposal for illustration of this point, there is not the slightest sign of recurrence one year after, nor is such probable.

Column 25. Effect on the Cord.

The effect on the cord varies widely, even among growths of the same nature, of much the same size, and apparently producing much the same effects, as far as general symptoms are concerned, and in cases where much the same kind of secondary changes appear to have occurred (see, for instance, Cases 47 and 48).

The cord was softened (*vide infra*) more frequently with intradural than extradural growths, the percentage for the former being 55, and for the latter 46, of the cases in which changes in the cord were noted as present or not. When softening occurs it appears always to pass through the stages of congestion (this being almost always noted as occurring in the neighbourhood of the tumour), red softening, yellow softening, and grey degeneration. All these require no detailed account. So too when the softening has interrupted any of the great tracts of fibres in the cord there ensues ascending and descending degeneration of the ordinary kind and extent.

One further point with regard to the softening requires notice, and that is its distribution. Of course naturally it is most marked opposite the centre of the growth, but its farther extension is of course a matter of much importance and interest. Of six cases in which it is recorded to have occurred, in four it spread downwards and in two upwards, one very slightly. Doubtless this distribution is due to thrombosis of the great median medullary vessels.

Column 26. Treatment.

For all the horrible sufferings of the fifty-eight cases in the Table, in only two was any treatment of avail, viz. Nos. 4 and 32. In the former case excision of a part of the growth relieved the pressure, and so the symptoms for a time. In the second the complete removal of the growth has, it may be hoped, obtained permanent relief. Unfortunately the condition of the patient, owing to the errors of diagnosis, has usually been made more hopelessly miserable by free use of the actual cautery, moxas and blisters, while in other instances the additional employment of mercury, iodide of potassium, &c., has been resorted to.

Column 27. Records of the Autopsy, especially with respect to the Presence or Absence of any other Lesion which, independently of the Tumour, would have caused Death.

The melancholy inspired by consideration of Column 26 is intensified by the facts of Column 27, for in no less than 74 per cent. of the extradural growths, and 83 per cent. of the intradural, the patient died simply from the direct effects of the tumour, *i. e.* from exhaustion (in a very large number of cases), owing to pain, &c., or from pyæmia owing to absorption from the bedsores, or from septic pneumonia, or from acute septic interstitial nephritis.

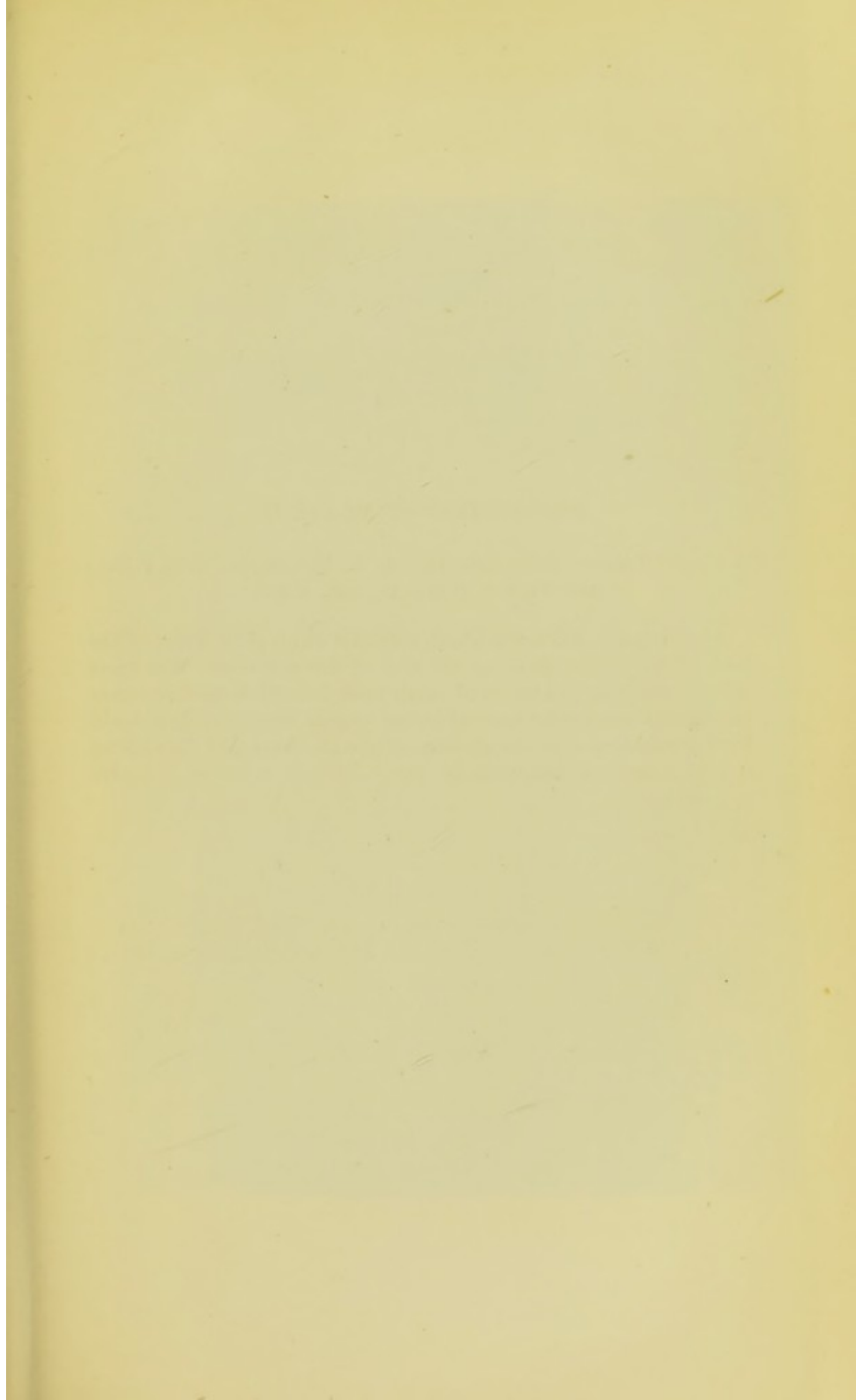
Roughly speaking, therefore, about 80 per cent. of these miserable cases could have been relieved entirely by operation, and those which were hopeless might by relief of pressure have been granted a euthanasia.

The simple effects of confinement and nerve exhaustion are seen in the four instances in which fatty degeneration is noted among the effects of the intradural growths.

Conclusions.

The lessons of the facts detailed in the foregoing pages are so extremely obvious that very few words are required to set them forth. They amount to this, that, granted the diagnosis is correctly made, there is but one treatment, viz. removal of the source of pressure by operation. It may at once be said, and rightly, that the question of diagnosis in the large majority of cases arises when only as yet one cardinal symptom is before us, most commonly **pain**, and that therefore a diagnosis of such certainty as to warrant exploration is not possible. To this nothing can be objected in view of the responsibility the surgeon takes upon himself, but at least absolution from the major part of such responsibility is obtained with the discovery of the first localising symptom independent of the constancy, the position, and the character of the pain. The differential diagnosis of the cause of painful paraplegias, material for which is given in the table, considered fully, would be quite beyond the object of the present paper, and must be reserved for another occasion. A close survey of the conditions under which tumours have been found will meanwhile afford the best aid to the recognition of the real nature of doubtful cases.

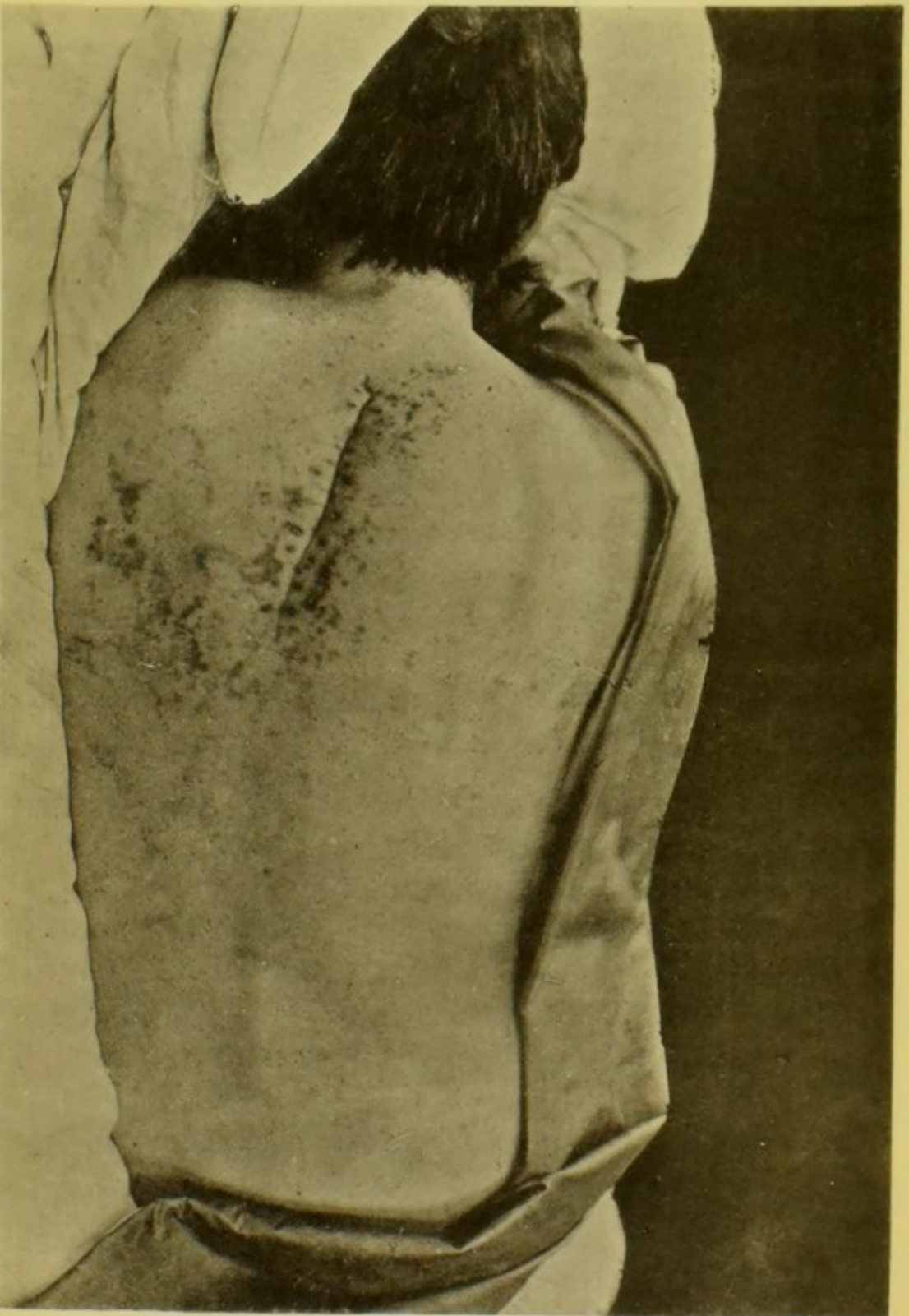
(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 407.)



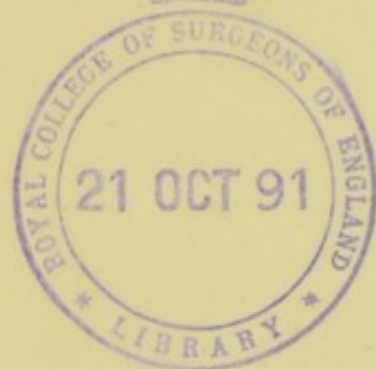
DESCRIPTION OF PLATE III.

A Case of Tumour of the Spinal Cord (W. R. GOWERS, M.D., F.R.S.,
and VICTOR HORSLEY, B.S., F.R.S.).

A photograph was taken about July 31st which gives a view of the back of the patient, showing the scar of the operation. The spots around the scar are traces of small pustules, which, however, gave the patient practically no trouble, and which were caused no doubt by the irritation of the large quantity of cerebro-spinal fluid soaking the dressings and dissolving the perchloride of mercury, &c., contained therein.



FROM A PHOTOGRAPH.



EXTRADURAL GROWTHS.

1

Sex and age.	Alleged cause.	History.				Symptoms.														Tumour.						Treatment.	Result.	Autopsy note of chief fatal lesion.	Reference.
		Personal.	Family.	a. Total duration.	b. Course of symptoms.	Pain.	Paraplegia, motor and sensory.	Reflexes.	Spasms, including clonus.	Rigidity.	Decubitus.	Nutritive changes.	Spine, physical examination.	Pupils.	Urine.	Voluntary changes.	Voluntariness.	a. Relation to dura.	b. Size.	c. Position.	d. Nature.	e. Effect on cord.							
1 M.	Lipoma :	—	—	1 year	—	Illness began with weakness in lower limbs; patient could not stand, but could extend legs in bed. Gradual weakness in lower limbs for few days before death; 13 months before admission patient felt her legs suddenly bend under her.	—	Motor paraplegia, sensory intact. Severe paraplegia, incomplete sensory paraplegia (could extend legs in bed). Gravid motor paraplegia and died with gangrenous vertebrae.	—	Noted in history.	Child caught scapulae and died with gangrenous vertebrae.	—	Nil discoverable.	—	—	—	—	—	Outside the dura mater.	Largest was 2 inches long (in fig.). Multiple lipoma, only one of size to produce changes in cord (8 figs.).	—	Cord retracted beneath largest tumour.	—	Death.	Paraplegia.	Albers, Atlas, Plate VIII, fig. 1, text, p. 28 of description of patient, 1865-1867.			
2 F.	—	—	—	—	Several days	—	—	—	—	Child caught scapulae and died with gangrenous vertebrae.	—	Nil discoverable.	—	—	—	—	—	Outside the dura mater.	Filled the whole breadth of the spinal canal.	The growth extended over the whole dorsal and lumbar portions of the spine, "undoubtedly compressing the spinal cord."	Lipoma.	Not noted.	Actual cautery applied 4 times in the lumbar region, produced a "little improvement."	Death.	—	Chapote, Bulletin de la Soc. Anatomique 1866-1867, vol. xii, p. 264, description of patient, vol. ii, p. 6.			
3 F.	—	—	—	2 years (7)	3 years (7)	Gradual onset of slight paraplegia after severe convulsions, side "spasms."	Incomplete right hemiplegia.	—	"Spasmodic action of the right half of the body," severe convulsions, with partial insensibility, when one year old, these "returned," and caused death when 3 years old in 3 hours.	—	—	—	—	—	—	Congestion of brain and spinal cord above the seat of the tumour.	External to dura.	2 1/2 inches long, "the breadth of the canal," 1/4 inch thick.	The tumour lay opposite 7th cervical and 1st dorsal vertebrae.	Lipoma.	Unfortunately not examined.	—	Death.	None whatever could be found; removal of contents of spinal canal.	Chief, Trans. of Pathological Society, 1865-1867, vol. xii, p. 265.				
4 M.	Congenital.	—	—	11 months (7)	2 months.	Gradual appearance of the neural tumour, accompanied by twitches in right leg.	—	—	Frequent spasms or twitches of right leg.	—	—	—	Tumour (1) visible projecting from the lower posterior surface of the sacrum.	—	—	—	—	(1) Outside the dura mater (re-removed by operation). (2) Central mass within the canal, arising from the seat of original growth, and pushing the cord aside.	(2) Resembling the end of the finger.	(1) Commenced probably opposite 1st sacral vertebra, and pushed its way into the canal, front at operation to reach to level of lowest point of sacro-coccygeal synchondrosis.	Lipoma.	The cord was pushed forward and to the left.	Excision of (1) with great relief of symptoms.	Death.	Acute peritonitis (necrotic death 6 weeks after wound healed and symptoms disappeared).	Atthol Johnson, Trans. Path. Soc., 1868-1871, vol. xii, pp. 15-18.			
5 F.	Sarcoma :	—	—	—	—	The nerve symptoms began with numbness and pain of the right arm and leg; the tumour compresses in the arm, and there the left limb were similarly affected.	Pain in neck.	Paralysis of right arm; incomplete paraplegia; paralysis of bladder, &c.	Repetitive recurrence after removal of sarcomatous growth in the thorax.	—	—	—	Swelling at the right side of neck and spine.	—	—	—	—	Outside the dura.	—	The tumour compressed the cord opposite the 6th cervical vertebra, and invading the spinal canal. Microscopically—epithelioid sarcoma.	Sarcoma of neck compressed the right side of the 6th cervical vertebra, and invading the spinal canal. Microscopically—epithelioid sarcoma.	Cord unchanged (7).	—	—	Sarcoma of vertebrae, laminae, glans, &c. Colclander, Trans. Path. Soc. of London, vol. 4, p. 115.				
6 —	—	—	—	—	—	—	Complete paraplegia.	—	—	—	—	—	—	—	—	—	—	Outside the dura.	"Small" mass.	Over the posterior column of the cord.	Sarcoma of the cord, involving the mass of the cord, and penetrating the intra-spinal foramen into the spinal canal.	Cord compressed.	—	Death.	—	Simon, Trans. Path. Soc. of London, vol. 4, p. 115.			
7 M.	Exposure to cold.	5 years before was kicked in side, running mother's side, for which was in hospital.	—	6 months.	4 months.	Course of symptoms began with pain in the left side and convulsions. A few weeks after admission felt weak and numb in his legs, and over his abdomen, next day. Complete motor and sensory paraplegia of lower extremities.	Severe (but "not extreme"), extending round the left side at level of 5th, 6th, and 7th, later became strong "grille pain."	At first all exaggerated, even in upper limbs; later completely lost.	Abolic-clonus.	—	Sacral and coccygeal.	Muscles of lower limbs rapidly wasted.	The pain in the back and side was increased by movement. Peroneus around the 5th dorsal spine showed much tenderness, and caused pain to pass down the right thigh.	Normal.	For a long time and, then, neural, and finally alkaline.	Erection of penis.	Frequent and severe (occurred much from bronchitis).	Outside the dura.	Enlarged and fusiform (see next column).	Growing from the periphery of the laminae of the 5th, 6th, 7th, 8th, and 9th dorsal vertebrae, penetrating posteriorly, and passing under the cord.	Round-celled sarcoma.	The cord was much attenuated, pushed aside by and completely softened by the growth. Below this point (i. e. 8-9 dorsal vertebrae) the cord was softened. According to the histological examination, the growth consisted of round-celled sarcoma, the direct cranial part, and in the anterior lateral.	Palliative.	Death.	Hypertrophy of heart, with extensive vascular degeneration and disorganization. Bronchitis and some small abscesses scattered through both lungs. Urinary tract showed signs of inflammation.	Vincent Morris, Brit. Med. Jour., 20th Dec. 1887, p. 1280.			
8 M.	—	—	—	Many months.	—	—	Incomplete motor paraplegia, and numbness in all the limbs, especially on the left side.	—	—	—	Marked decubitus.	—	—	—	—	—	—	Outside the dura.	Banister's egg.	The tumour was situated upon the 5th cervical spine and several arches, and the right 5th cervical spine—(1) lateral column consisted of round-celled sarcoma, and oval expansion in a connective tissue stroma.	Cord "dissolved" (microscopically, of) at seat of projection, and the right 5th cervical spine—(1) lateral column consisted of round-celled sarcoma, and oval expansion in a connective tissue stroma.	Mercury, iodide of potassium, and caustics.	Death.	N.B. The growth absorbed most of the laminae and transverse processes of the vertebrae.	Cyfe, Trans. Path. Soc. of London, vol. vi, p. 40.				

[illegible]

[illegible]

INTRADURAL GROWTHS.

4		History.										Symptoms.										Treatment.										Result.										Autopsy note of other lesions.										Reference.									
Sex, age, date.		Alleged cause.		Personal.		Family.		a. Total duration.		b. Duration of observation.		c. Course of symptoms.		Pain.		Paraplegia, motor and sensory.		Reflexes.		Spasms, including clonus.		Rigidity.		Decubitus.		Nutritive changes.		Spine, physical examination.		Papic.		Urine.		Vaso-motor changes.		Vomiting.		a. Relation to diet.		b. Bow.		c. Fusion.		d. Nature.		e. Effect on cord.		Treatment.		Result.		Autopsy note of other lesions.		Reference.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
Myeloma :																																																													
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50												
1	3	5	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34</																												

INTRADURAL GROWTHS—continued.

[illegible]

INTRADURAL GROWTHS—continued.

		History.					Symptoms.										Tumor.													
No.	Sex, age	Alleged cause.	Personal.		Family.	a. Total duration, days.	b. Duration of symptoms.	c. Course of symptoms.	Pain.	Paraplegia, motor and sensory.	Reflexes.	Spasms, including clonus.	Rigidity.	Decubiti.	Nutritive changes.	Spinal, physical examination.	Pupils.	Urine.	Vaso-motor changes.	Vomiting.	d. Relation to dura.	e. Size.	f. Position.	g. Nature.	h. Effect on cord.	Treatment.	Result.	Autopsy note of gross findings.	Reference.	
			4.	5.																										9.
10	M.	Myxoma (continued): Wound of back.	Good.	—	3 years	3 years	Gradual development of intermittent pain; then paralysis of left lower limb, then right, etc.	Agonizing.	Complete motor and sensory, also bladder and rectum.	Exaggerated highly.	Very severe.	Very marked, usually in extension.	Commencing.	General emaciation.	Tenderness on percussion, and lateral curvature.	Normal.	Paracent.	None.	None.	Inside dura.	—	Between the 2nd and 4th dorsal nerves, on the left side of cord.	Myxoma (?)	Severely indurated, probably with secondary and descending degeneration.	Excision of growth.	Recovery.	—	Green and Harvey, Med. Clin. Trans., 1888.		
11	F.	Sarcoma:	—	—	—	—	—	—	Complete of both lower extremities, bladder, and rectum.	Not observed.	—	—	Diameter 8 in. over sacrum; inner side of both knees, on feet, and inner side of both arms.	Thick-muscles, fatty degeneration; atrophy; leg severely altered.	—	—	—	—	Between pia mater and cord, quite distinct from latter.	Bean.	Between 7th cervical and 1st dorsal vertebrae.	Sarcoma.	Grey degeneration; glomerous gray at periphery, condensed, with slight vascularization.	—	Death.	None; fatty degeneration of organs.	Marshall, Dublin Clin. No. 15, p. 28.			
12	F.	—	Had 5 children; measles not confluent.	—	1 year	3 months	Illness began with pain in pelvis and in the left leg, and gradually increased. The pain began in the right leg, then both legs, became weaker.	—	Both lower limbs showed almost complete motor paralysis on admission of weakness; 4 months before death bladder paralysis; 3 months before death sensation diminished; and pain increased in the right leg. 1 month before death motor and sensory paralysis absolute.	—	Normal.	—	Decubiti established 3 months before death. This skin was not opened; the spinal canal near the 5th lumbar vertebrae.	None on admission.	—	Normal at first, became fixed 1 month before death; dark brown, black, irregularly fixed, and parietal.	—	—	—	In the pia mater, between the dura and the cord, from both sides of which the tumor was distinct.	8 cm. long, 1.5 cm. broad, 1.5 cm. thick.	The growth contained the dura; few gray-matter cells and post, of both sides contained it the mass.	Spindle-celled fibro-sarcoma; yellowish white color.	The cord was not affected by the tumor. There was well-marked ascending degeneration throughout the posterior columns in their whole length, i.e. in the lumbar region the whole section of the posterior columns, but in the upper thoracic and cervical enlargement only Goll's columns were affected. The degeneration was traced up into the sacral ganglia.	—	Death.	None, save effects of pyramidal infection from the decubiti and decomposition of urine.	Simon, Archiv. für Psychiatrie und Nervenk., Band 1, 1879, p. 114.		
13	M.	—	Had had lead.	—	—	—	Gradual onset.	—	Incomplete paralysis.	—	—	—	—	—	—	—	—	—	—	Between dura and cord in pia mater and stretched.	Peas.	Scattered all over the cord and base of the brain.	Melanotic sarcoma.	Not noted.	—	Death.	—	Vincent, Die Krankheiten des Gehirns, Band 1, p. 123.		
14	M.	Fall on blow on spine.	Pubic, drainer, and had had syphilis.	—	17 months	3 days	Illness began with pain in right upper limb (see column 15), followed by paralysis of the limb; 3 months later weakness, etc., fell in right leg, arm, etc., followed by vaso-motor changes in the hip, and, finally, whole lower limb; 7 months after onset observed in left side some symptoms. Complete motor paralysis rapidly set in, and at the same time sensory paralysis also. Later began painful spasms in all the limbs, especially in the legs.	Painful spasms; towards the end of life boring pains were felt; sensory pain in the vertebrae, especially the upper of thoracic, and high-ly, bladder and rectum; spasms; respiratory difficulty. The largest decubiti with copious.	Complete motor and sensory paralysis; pain in the lower limbs, bladder, and rectum.	Flaccid reflexes weak.	Painful spasms in all limbs, especially in the lower limbs. These were rapidly fixed, and, later, the left lower limb.	Not recorded.	—	No pain on pressure; nothing abnormal discoverable.	—	—	Reflexes and swelling of the right shoulder. Later whole arm and hand were fixed and reddened. In cord, but was seated in right hip, and, quite distinct from that later. Repeated later in left side in the same order.	—	—	—	Grew from Pigeon's egg.	5 1/2 inches below the lower border of the peas.	5 1/2 inches below the lower border of the peas.	Sarcoma.	From the 7th cervical nerve upwards to the bulb the cord was softened. The grey substance was reddish. Where directly pressed upon by tumor (see column 15) the cord is completely effaced.	—	Death.	None.	Trojan, Goss, and Bell, Archiv. für Psychiatrie und Nervenk., Band 1, 1879, p. 102.	
15	F.	Fit of anger.	Good.	1 year	1 month	Illness began with pain in the right side of the body, between the scapular and the spine; a little later it attacked the left side of the body, considered hysterical. Next pains of lower limbs. Complete paralysis 6 months from onset; paralysis of bladder and rectum.	Excessive pain, especially at the base of the thorax, towards sensory paralysis, and, especially, pains of lower limbs, the legs and thighs.	—	Complete motor and sensory paralysis; bladder and rectum.	Excessive full just before death, when diminished.	Marked.	—	Sacral.	General emaciation.	—	—	—	—	—	Inside dura, growing within white matter, 2-3 cm. long, 1-2 cm. broad, and, quite distinct from cord, and only slightly adherent to pia mater.	5 or 6 cm. long, 1-2 cm. broad.	15 cm. above the lower end of the cord, pressing on the right side of the cord.	Oval, elongated form, with soft, lobed extremities; brownish, sarcoma (?) More, same. Round, and spindle-cells.	The portion compressed was softened and altered through its whole thickness. There was also ascending and descending degeneration well marked. Numerous over-cells equine, lumbar enlargement inflamed and suppurating.	—	Death.	N/2, pyramidal in the lungs.	Louveau, Atlas d'Anatomie Pathologique, 1867, p. 647.		
16	M.	Lying on damp grass.	Good, save a kind of fever in early life without sequelae.	—	9 months	4 weeks	On waking after exposure to cold felt no paralysis in legs; but patient got home but slowly; at same time functions and acute pains in legs, which gradually crept up from the ankles up to the lower half of thorax.	Severe in lower extremities.	Complete motor and sensory paralysis, as high as lower half of thorax, the attachments of which were sensitive.	Very weak.	Tremor.	—	Sacral.	Atrophy of lower limbs and, later, of whole body.	N/2, in examination.	—	Normal.	—	In cord.	—	In middle 3rd of cord.	Sarcoma (?)	In middle third of cord there were two hard tumors of some nature as the growth on the vertebrae, ? sarcoma.	Tennis, strychnia, arsenic, and bathing the whole body.	Death.	Infiltration of all vertebrae with sarcoma (?) tissue; also some pelvic bones, bladder, and prostate; hydrothorax.	Yerg and Diller, Dublin Clin. No. 25, 1861, p. 303.			

* One month before death the patient gave birth to a living child. The labour was normal.

Case	Sex	Age	History.			Symptoms.																	Tumour.					Treatment.	Result.	Autopsy note of other fatal lesion.	Reference.
			Alleged cause.	Personal.	Family.	a. Total duration.	b. Duration under observation.	c. Course of symptoms.	Pain.	Paraplegia, motor and sensory.	Reflexes.	Spasms, spasmodic clonus.	Rigidity.	Duchenne's.	Nutritive changes.	Spine, physical examination.	Papils.	Urine.	Vaso-motor changes.	Vomiting.	a. Relation to dura.	b. Size.	c. Position.	d. Nature.	e. Effect on cord.						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			
E. 61	F.	40	Fibroma (continued):			1 year	—	Began with paraplegia after each-ventral, which was attended with severe pain along the spine. Motor paraplegia. Very little sensory life. Treated 3 months; was not able to walk. Pain continued. Next year extensive hæmorrhage, increased pain in back, and motor paraplegia.	Refused to lie on left side, as that hindered, then in right region of the stomach and lower limbs. From there, through the lower limbs, passed the twelfth dorsal and the lower limbs.	Motor—Complete paraplegia, with sensory loss in lower limbs. Persevere.	Excessive.	Frequent.	Marked flexion.	Large nodose.	General emaciation.	Uppermost dorsal vertebra, tender on pressure, especially Nos. 1, 2, and 3. Also the most tenderness on the right side of the spine, extending to the right scapula. The pain, on pressure, extended into the side.	—	—	—	—	Between dura and cord, arising from the twelfth dorsal nerve with a cerebral cystic wall.	1 inch long, 1 inch thick.	On right side, partly surrounded by a pink, extending from the left of the anterior median fissure, and posterior median and stretched over it.	Round, nodular, whitish, dark in places, interior cystic. The cavity of the tumour. Walls of cyste whitish, clotted. The cyste filled covered with thin fibrous tissue, incompressible. The posterior part of tumour. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	Cord compressed, whitish, dark in places, interior cystic. The cavity of the tumour. Walls of cyste whitish, clotted. The cyste filled covered with thin fibrous tissue, incompressible. The posterior part of tumour. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	—	Death.	No.	Kidney, Brain, and other fatal lesions.		
F. 62	F.	40	Dumb-dyslexia.			Good.	—	1 year	1 month	These began with paraplegia which was attended with severe pain along the spine. Motor paraplegia. Very little sensory life. Treated 3 months; was not able to walk. Pain continued. Next year extensive hæmorrhage, increased pain in back, and motor paraplegia.	Refused to lie on left side, as that hindered, then in right region of the stomach and lower limbs. From there, through the lower limbs, passed the twelfth dorsal and the lower limbs.	Motor—Complete paraplegia, with sensory loss in lower limbs. Persevere.	Excessive.	Frequent.	Marked flexion.	Large nodose.	General emaciation.	Uppermost dorsal vertebra, tender on pressure, especially Nos. 1, 2, and 3. Also the most tenderness on the right side of the spine, extending to the right scapula. The pain, on pressure, extended into the side.	—	—	—	—	Between dura and cord, arising from the twelfth dorsal nerve with a cerebral cystic wall.	1 inch long, 1 inch thick.	On right side, partly surrounded by a pink, extending from the left of the anterior median fissure, and posterior median and stretched over it.	Round, nodular, whitish, dark in places, interior cystic. The cavity of the tumour. Walls of cyste whitish, clotted. The cyste filled covered with thin fibrous tissue, incompressible. The posterior part of tumour. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	Cord perfectly compressed, whitish, dark in places, interior cystic. The cavity of the tumour. Walls of cyste whitish, clotted. The cyste filled covered with thin fibrous tissue, incompressible. The posterior part of tumour. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	—	Death.	Tubercle (?) in pyramidal, sup. horn, lateral, R.	Malaise, Scholl's, Tubercle, R. 111, 181, p. 302.
M. 63	M.	40	Probably bad on back many years before.			Extremely vigorous and active, but on back many years before.	Very good.	8 years.	3 years.	These began with paraplegia which was attended with severe pain along the spine. Motor paraplegia. Very little sensory life. Treated 3 months; was not able to walk. Pain continued. Next year extensive hæmorrhage, increased pain in back, and motor paraplegia.	Pain in left side only, at first tender, then in right region of the stomach and lower limbs. From there, through the lower limbs, passed the twelfth dorsal and the lower limbs.	No loss of sensation, power or sensibility.	Not observed.	See No. 9.	None.	None.	Slight swelling, latterly general.	Nothing noticeable, no special tenderness.	Lithates always present in excess, phosphates, no albumen or sugar.	Not observed.	Between dura and pia, separate from both.	Oval, long, broad.	On left side of the cord, apparently opposite the origin of the 14th dorsal (?) nerve (?) cm. 12 in above the 12th dorsal (of the cord), the posterior root of the 12th dorsal (?) nerve being stretched over it.	Nodular, hard, convex, covered with thin capsule, containing a whitish, clotted, cystic wall. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	Cord perfectly compressed, whitish, dark in places, interior cystic. The cavity of the tumour. Walls of cyste whitish, clotted. The cyste filled covered with thin fibrous tissue, incompressible. The posterior part of tumour. <i>Meningeal</i> —Vasculature and contained numerous blood-vessels of very phlophic also found.	—	Death.	Tubercle (?) in pyramidal, sup. horn, lateral, R.	Malaise, Scholl's, Tubercle, R. 111, 181, p. 302.		
G. 64	F.	40	Pneumonia.			1 year	13 months	First felt pain in left leg, extending down the outer surface of the thigh, extending to the abdominal region of the right leg. In 2 months complete paraplegia.	Complete motor paraplegia, with sensory loss in lower limbs. Persevere.	Exaggerated.	Frequent and severe.	Severe; legs flexed on abdomen.	Large nodose.	None what.	—	—	—	—	—	Between dura and cord, growing from the surface of dura.	Length 1½ in. breadth ¼ in.	6th and 7th cervical nerves; between 6th and 7th cervical nerves on the left side of the cord.	Pneumonia (?) with a thrombus of delicate fibrinous mass, or a mass of cerebral, in places spherical calcareous masses, R.	The growth pushed the cord to the right, and at the same time a deep depression in its left side, the cord, where compressed, was thinned, but not ruptured.	Blister, bluish-grey of mercury and calomel.	Death.	None whatever.	Wegman, Trans. of the Path. Soc. of London, vol. vii, p. 31.			
H. 65	F.	40	Pneumonia.			1 year	3 months	The symptoms began with the left leg, extending down the outer surface of the thigh, extending to the abdominal region of the right leg. In 2 months complete paraplegia.	Complete motor paraplegia, with sensory loss in lower limbs. Persevere.	Occasional spasms.	—	Reborens.	—	—	—	—	—	—	Between dura and cord, arising from the surface of dura.	Oval, length 1½ in. breadth ¼ in.	Growing from the arch of the arch, between the 6th and 7th cervical nerves on the left side of the cord, the posterior root of the 12th dorsal (?) nerve being stretched over it.	Pneumonia (?) with a thrombus of delicate fibrinous mass, or a mass of cerebral, in places spherical calcareous masses, R.	Cord was much compressed, and its left side was hollowed out by a white body, which was normal.	—	Death.	No. Body very large, sup. horn, lateral, R.	Coley, Trans. of the Path. Soc. of London, vol. vii, p. 31.				

INTRADURAL GROWTHS—continued.

9

Case	Sex	Age	History.					Symptoms.											Tumour.											Treatment.	Result.	Autopsy note of other fatal lesion.	Reference.
			Personal.	Family.	a. Total duration.	b. Duration under observation.	c. Course of symptoms.	Pain.	Paraplegia, motor and sensory.	Reflexes.	Spasms, including clonus.	Rigidity.	Decubitus.	Nutritive changes.	Spinal, physical examination.	Pupils.	Urine.	Vaso-motor changes.	Vomiting.	d. Relation to dura.	e. Size.	f. Position.	g. Nature.	h. Effect on cord.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29					
Pneumoma (continued):																																	
61	F	41	—	—	—	6 years	1 month	Illness began with weakness in legs, gradually complete paralysis	—	Complete motor paralysis of lower limbs; incomplete sensory deficit; complete paralysis of bladder and rectum	—	—	Very marked in flexion	Sacral	General atrophy of body	—	—	—	—	—	Inside dura, growing from ligamentous tissue, separate from dura and cord	3 cm. long; oval	Mid-dorsal (7), left side	Pneumoma, very firm, oval. Microscopically, fibrous tissue, dense, fibrous, with many small vessels which do not seem to be the normal blood vessels. The cord was pressed to the opposite side, and the dorsal root was torn. The cord softened and of a deep red colour for a distance of 2 or 3 cm., being most affected opposite the center of the tumor.	—	—	Death	Nil else	Leutenants, Atlas d'Anatomie Pathologique, 1871, p. 344.				
62	F	63	—	—	—	About 14 years	4 months	Gradual weakness in left lower limb, with stiffness, followed by severe muscular atrophy, the right lower limb became affected; walking and standing became impossible	Very severe. Referred to left side of chest and lower limb, and described as like a dog pawing the house, increased by slightest movement of lower limb; no tenderness at any point. Paralysis of lower limbs, no sensory deficit.	Right lower limb rigid in extension; left lower limb rigid in flexion. Both limbs forced and abducted	Exaggerated	Clonic spasms, elicited in left lower limb easily by reflex irritation	Right lower limb rigid in extension; left lower limb rigid in flexion. Both limbs forced and abducted	Frightfully extensive: sacral, trochanteric, knee, malleoli, toes, etc.	No wasting	Tenderness on pressing of the sides of the dorsal spine; no localisation possible	—	Persistent and bloody	Edema of both lower limbs	—	Inside dura, between it and cord	Oval. Length 2.5 cm., breadth 1.5 cm.	(7) Between 8th and 9th dorsal vertebrae, on anterior surface of left subarachnoid space, 3 cm. above the broadest point of the lumbar enlargement	Pneumoma. Tumor was contained in a thin, fibrous sheath, from which it was separated by a thin layer of soft tissue. The tumor consisted of a mass of soft, white, gelatinous tissue, containing many small vessels, some of which were dilated. The cord was compressed and displaced to the right.	The left half of the cord was affected, crushed, and encased by a thin layer of soft tissue. The growth, which pushed the median sulcus to the right and backwards. At the seat of compression the cord was softened, grey, and gelatinous. Microscopically—This part of the cord showed numerous nuclei and Diller's capsules (?), connective tissue, few fibres and astrocytes, nerve-cells, most normal; others globose and without processes. There was secondary degeneration in the posterior column, most marked on the right side; below there was descending degeneration (grey) in the posterior part of the lateral column; also most marked on the left side.	—	Death	Polyspermatitis; nil else. The brain-joints contained a large quantity of pus. The intervertebral cartilages were yellowish, nil else.	Charcot, Archives de Physiologie, tome 1, 1885, p. 291.				
Tubercle:																																	
63	M	11	—	—	—	1 year	—	Began with the convulsions	—	—	—	—	—	—	—	—	—	—	—	—	Between the dura and arachnoid	Not	Opposite the 3rd cervical vertebra	Tubercle	Cord compressed. Nil else mentioned	—	Death	Tubercular phthisis	Communicated by Gendreau to Charcot, M. de la Moelle Epandue, tome 2, p. 502.				
64	F	23	Menstrual shock	—	—	6 weeks	5 weeks	Began with "low fever," and then the symptoms of Addison's disease began. The first severe symptom was inability to "command" the left arm. Then followed characteristic movements in the left arm and leg, and these "twitchings" subsequently became general	—	—	—	—	—	—	—	—	—	—	Present (due to Addison's disease)	Within dura	Haricot bean	Grew from the centre of the cord, and spreading backwards into the posterior surface of the lumbar enlargement	Firm, white growth, consisting of granular matter, fibres, cells, and cholesterol. Tubercle (?)	The cord was widened, but of natural color and firmness	—	Death	Yellow tubercle of adenoids; other organs healthy, except a few old tubercular nodules, and powerfully adherent at both apices	Brundage, Trans. of the Path. Soc. of London, vol. xii, 1881, p. 246.					
65	M	38	Flow on lumbar spine	—	—	3 years	5 months	Pain following blow in sacrum and lower leg, later on sitting down, severe pain extended into lumbar tubercles. Condition improved shortly before death, so that he could lie down again	Severe burning pain, first referred to sacrum and as shooting into legs; later felt on sitting down, severe pain extended into lumbar tubercles. Condition improved shortly before death, so that he could lie down again	Complete motor paralysis of both legs; complete sensory paralysis of left leg, in the form of numbness, tingling, and pain; complete paralysis of bladder	—	—	—	—	—	—	—	—	—	Contained blood before death	Both lower limbs numb and cold	Within, and separate from dura and cord	Whole length of cauda equina	In site of 8th cranial nerve, especially towards the left side	Yellow tubercle, multiple, but aggregated to one mass	Cord normal. Nerve of cauda equina involved (?)	—	Death	The lumbar and sacral portions of the lumbar vertebrae were carious. Nil else recorded	Fisher, Trans. of the Provincial Medical and Surgical Association, 1845, vol. x, and Schmidt, Jahrbuch, Bd. 29, p. 356.			
66	F	31	—	—	—	3 months	—	Illness began with cough and pain on movement	On movement, especially very severe	Complete motor paralysis of lower limbs; sensory deficit of left lower limb, and apparently almost of left upper limb	Superficial plantar present on right, absent on left	—	Considerable; limbs remaining in flexion	—	General emaciation	No change recognizable	No reaction	—	—	—	—	In the cord	Length 35 mm., thickness 9 mm.	In left lateral column, opposite 8th and 7th dorsal vertebrae	Yellow tubercle, mass, was both caseated and blood	Dorsal cord swollen and softened at level of 6-7 dorsal vertebrae for a distance of 12 mm., owing to presence of tumor on left half; right half preserved, made, individual columns still obvious	Treated for syphilis	Death	Right lung, small cavity at apex; bronchial glands carious	Kohls, Gerhardt's Handbuch der Kinderkrankheiten, Bd. 2, 1880, p. 422.			

10		INTRADURAL GROWTHS—continued.																				Tumour.					Treatment.		Result.	Autopsy note of other fatal cases.	Reference.
Sex, age, date of case.		History.								Symptoms.												Tumour.					Treatment.		Result.	Autopsy note of other fatal cases.	Reference.
Sex.	Age.	Personal.		Family.		Illness.		Pain.	Paraplegia, motor and sensory.	Reflexes.	Spasms, including clonus.	Rigidity.	Decubitus.	Nutritive changes.	Spine, physical examination.	Papilla.	Urine.	Vaso-motor changes.	Vomiting.	a. Relation to dura.	b. Size.	c. Position.	d. Nature.	e. Effect on cord.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			
10	M.	38	Parasitic Growth: Intermittent ever when a child and time		—	5 months (7)	8 months (7)	Pain in left upper limb, thought to be of consequence of pericervical cysts in the left hand.	2 months before death pain in left foot, right of left—(75, 76), severe right preventing sleep at night, paralytic, right morning pain in the left hand.	Complete of pain in left foot, lower limb, right of left—(75, 76), severe right preventing sleep at night, paralytic, right morning pain in the left hand.	—	No spasms	—	Left heels, motor border of right foot, on chin, bone; this gradually increased, and led to pyramic infection	General wasting of body	7th cervical vertebra, painful on pressure or movement	Left small, contracted, constantly numbly, right normal	Normal till 3 months before death, then commencing pain, etc.	Oedema in both lower limbs late; buter visible only in lower limbs	—	In pin mass between dura and cord	(1) 5 cm. long vertically by 1.8. (2) 3.8 cm. long vertically by 1.1 cm.	(1) Immediately below cervical enlargement. No 1 flattened; 2.5 cm. by 1.8 cm. this cord on left side of cord	Two chondrioma cysts, containing opacified fluid. Cyst No. 1 flattened; 2.5 cm. by 1.8 cm. this cord on left side of cord	Excess of cerebrospinal fluid. Cyst No. 1 flattened; 2.5 cm. by 1.8 cm. this cord on left side of cord	—	Death	Cerebral mass in apex of left lung, bronchitis, pyelitis, cystitis	Statis, R. (1885, p. 118)		
10	Y.	48	—		—	Mother 11 years	1 year	Illness began with numbness, ache, stinging pain, loss of power of hand.	Severe pain later in the limbs, left and right leg.	Paralysis of all the limbs, left and right leg, accompanied sometimes with loss of consciousness. At other times not. Later paralytic of bladder and rectum	—	All limbs frequently twitch, and remain extended or flexed	Extensive in late stages	—	—	—	—	—	—	Inside dura and arachnoid, scattered over cord, etc.	Numerous cysts, varying from a pin's head to a bean	Numerous in the arachnoid, containing the cord. A few found in the cervical and upper dorsal regions. Numerous cysts in brain	Cysticercus	Appeared subacute; doubtful, as decomposed	Blister, Pot. Brom., arsenic, Ac.	Death	Cysticercus in brain; not important	Warghal, Br. (1885, p. 62)			
15	Y.	23	Syphilis		—	—	—	Illness began with numbness, ache, stinging pain, loss of power of hand.	Motor leg; later paraplegia; later left leg; later paraplegia. Secretion probably 7)	—	—	—	Probably	—	—	—	—	—	—	Within the dura, in the cord	Length 1 inch. Size of nut	On right side of lumbar region, adherent to posterior root	Hard, opaque, yellow, amorphous	—	—	Death	Few granules in liver and lungs	Witt, O. (1885, p. 100)			
18	M.	22	—		—	1 year	—	Rapid progression	Very severe pain shooting from the sacrum into the legs	Complete motor and sensory 7) paraplegia	—	—	Present	—	—	—	—	—	—	Between dura and cord	Small walnut	Posterior surface of cord, where the conus caudalis begins	Not stated	Spinal cord was slightly flattened by the growth, but otherwise quite healthy	—	Death	Nothing noted	Leyden, Klin. der Nervenkrankheiten, Bonn, 1874, p. 468			