THE SURGICAL APPROACH TO THORACIC INTERVERTEBRAL DISC PROTRUSIONS

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A number of writers have drawn attention to the disappointing results of operation in cases of posterior thoracic intervertebral disc protrusions.

Logue (1952) in a review of 11 cases reported total functional transection of the cord following laminectomy in five patients, all of whom were seriously disabled pre-operatively. Others have had comparable experiences, exemplified also by the first case in this personal series (Hawk, 1936; Love and Kiefer, 1950; Müller, 1951).

Several factors predispose to an unfavourable outcome.

First, the compressive lesion lies anterior to the spinal cord, and is commonly median in position so that laminectomy provides the least favourable access.

Secondly, the protrusion is often a hard calcified excrescence, and may have a bulbous extremity adhering tightly to the dura. All but one of the protrusions in the present series were of this nature; softer rubbery protrusions have been reported (Epstein, 1954) and one of this type was encountered in Case 6.

Thirdly, the blood supply of the spinal cord may already be in jeopardy, as evidenced by an ominous bluish translucency where it is stretched over the protrusion. Any manipulation may be sufficient to cause a complete and permanent interruption of conduction.

Under these circumstances some surgeons have advised that operation should be confined to laminectomy and division of denticulate ligaments, without removal of the lesion (Müller, 1951; Logue, 1952).

Following the unhappy experience with Case 1, Mr. G. L. Alexander suggested a trial of the lateral approach which is now accepted as appropriate for selected cases of Pott's disease of the spine and is technically an extension of costotransversectomy. As applied to cases of tuberculous spondylitis with paraplegia, the operation is mentioned by Seddon (1935) describing a case operated on by Mr. Norman Capener of Exeter and further accounts were given by Alexander (1946) and by Dott (1947).

We now have experience of six patients treated in this way.

Case Reports

Case 1.—Mrs. A. F. H., aged 40 years, had noted weakness and numbness of the right leg and slight urgency of micturition for three months.

Examination revealed spastic weakness of the right lower limb, patchy cutaneous sensory loss below the eleventh thoracic segment on the right, and impairment of joint and vibration sense in both lower limbs. During the next eight months spasticity and weakness of the left lower limb developed, but there was some improvement on the right. Myelography was performed on two occasions, with negative results. The significance of calcification in the T9-10 disc space was unfortunately not appreciated.

Repeated examinations of the cerebrospinal fluid revealed a mild increase in protein, but no evidence of a block on manometry.

Almost a year after she was first examined, new symptoms presented, namely, attacks of severe burning and stabbing pain, first in the region of the left anterior superior iliac spine, and later, even more severely, in the right groin. These pains were unaffected by movement or by coughing. Despite this, considerable objective motor and sensory improvement in the lower limbs was noted.

At this stage myelography was repeated, and a partial interruption of the flow of opaque medium was observed at the level of a rounded bony density at the ninth-tenth thoracic disc space. Review of the films now also clearly indicated calcification of the disc.

Exploration through a standard laminectomy showed the spinal cord tightly stretched over an anterior protrusion and a slight bluish discoloration at the predicted level. The operation note states:

"Further bone was removed laterally so as to enable a careful exploration to be made both intrathecally and extrathecally anterior to the cord, where a projecting bony knob was palpable. An attempt was made to remove this . . . : it was found, however, that the summit of the protrusion was adherent to the anterior surface of the theca and could not be removed without producing serious disturbance and traction on the cord. This portion therefore had to be left *in situ*. . . ."

A flaccid paraplegia with sensory loss up to the tenth

thoracic segment was evident after this operation. The fact that spasticity and extensor plantar responses failed to develop encouraged the hope that functional transection might be incomplete, and some recovery of conduction still possible. Accordingly a further operation, using the lateral approach, was performed two months after the first.

In contrast to the previous experience, it was now found that the bony protrusion, together with the adherent portion of dura, could be removed easily without any additional disturbance to the cord. Unfortunately there was no improvement in function, and the patient remains paraplegic.

This case history is presented in some detail because it shows a number of features commonly found in these cases. The variability in the neurological condition, the hard adherent central protrusion, and the absence of a spinal subarachnoid block are noteworthy. The disastrous consequences of the initial operation are all too familiar. This case illustrates also the importance of very careful myelography; only at the third attempt was a partial interruption of flow visualized although the lesion was presumably present on the previous occasions.

A further five patients, whose cases are presented

briefly, have since been operated on by the lateral approach.

Case 2.—Miss A. T., aged 46 years, presented with a history of sudden onset of pain round the right lower ribs one year and nine months before admission. This was apparently associated with a febrile illness, and a diagnosis of pneumonia was made.

When she began to get up again she noticed difficulty in walking and numbness below the waist. Apart from some frequency of micturition sphincter control was not disturbed.

Examination showed increased tone and extensor responses in both lower limbs with slight weakness on the right and cutaneous sensory depression up to T6-7 segment. Lumbar manometry was normal. The cerebrospinal fluid contained 43 mg. protein per 100 ml.

Radiographs showed a calcified disc at T7-8 with posterior osteophytes (Fig. 1), and myelography an oval anteriorly situated filling defect (Fig. 2).

At operation a large disc protrusion, mainly hard, but with a softer apex, was removed.

The patient recovered from the operation uneventfully, and three years later had no neurological abnormality apart from exaggerated knee jerks.

Case 3.—Mrs. E.N.S., aged 59, presented with a history of numbness, a feeling of heaviness in the lower

FIG. 1

FIG. 1.—Large posterior osteophytes (Case 2).

FIG. 2

FIG. 2.—Myelogram showing characteristic filling defect (Case 2).

FIG. 3.—Disc calcification and posterior osteophytes demonstrated by tomography (Case 3).

limbs and increasing difficulty in walking for three months, and frequency of micturition.

On examination she had a spastic paraparesis, more marked on the right, impaired cutaneous sensation below T9 segment, and loss of vibration sense in the lower limbs.

Lumbar manometry showed only a sluggish response to jugular compression. The cerebrospinal fluid contained 190 mg. protein per 100 ml.

Radiographs showed calcification of the T9-10 disc space, with posterior osteophytes (well shown by tomography in Fig. 3). Myelography revealed a block at T9-10.

A large calcified disc protrusion at the anticipated level was removed at operation.

The patient recovered uneventfully, and one year later was walking normally. Brisk tendon jerks and a dubious right extensor plantar response remain, but there is no sensory impairment.

Case 4.—A man, aged 58 years, had a long-standing lower dorsal kyphosis with wedging of the T8-12 vertebral bodies and marginal osteophytes.

Following a heavy fall onto the buttocks one year and four months before admission, weakness of the legs, first the left and latterly the right, had begun, and become progressively worse. Frequency of micturition was also noted.

On examination there was very marked spasticity with some weakness of both legs, and rather patchy sensory loss below T10 dermatome.

Lumbar manometry was free, and the cerebrospinal fluid contained 39 mg. protein per 100 ml.

Myelography revealed an almost complete interruption of flow at T11-12, with a posterior protrusion of the disc at this level.

At operation it was found that the adjacent posterior margins of the eleventh and twelfth vertebral bodies formed a prominent transverse ridge, but no actual disc protrusion could be identified. It appeared that the theca and cord were rather sharply angled over the summit of the kyphosis. The posterior portions of the vertebral bodies were therefore removed, so as to diminish the degree of angulation, since it was thought that this was a major factor in causing spinal cord compression.

Post-operatively this patient showed little change neurologically, and remains grossly disabled.

Case 5.—Mrs. E. L., aged 55 years, complained of numbness and slight loss of power in the legs, gradually increasing over a period of five months. Clinically she presented a partial Brown-Sequard syndrome, with spastic weakness and impaired posterior column sensibility in the left lower limb, and relative hypalgesia on the right up to T11 dermatome. She had noted a little urgency of micturition. Apart from a little backache, she had had no pain.

Lumbar manometry revealed no evidence of spinal subarachnoid block. The cerebrospinal fluid contained 51 mg. of protein per 100 ml.

Radiographs of the spine, including tomograms, showed a calcified disc protrusion at T10-11. The diagnosis was confirmed by myelography.

At operation a very large protrusion, consisting of rather soft, partially calcified pultaceous material, was removed completely.

Post-operatively there was a period of urinary retention, but this rapidly resolved, and at the time of discharge 17 days after operation there was no demonstrable weakness of the legs, and sensory loss consisted only of minimal hypalgesia over the distal part of the left lower limb.

Case 6.—A 31-year-old man missed his footing and twisted his back while stepping off a ladder. A few days later, he noted pains in the lower part of the back, radiating down the backs of both lower limbs to the feet. Over the course of the next nine weeks he complained of increasing weakness and stiffness of the legs. At first he had "electric shock" sensations in the legs, but these were fairly rapidly replaced by numbness, beginning round the hips and spreading distally. There were no bladder symptoms.

On examination, he displayed marked spasticity of the lower limbs with bilateral extensor plantar responses and weakness of dorsiflexion of the feet. He was, however, able to walk unaided. Sensory testing revealed complete analgesia and thermal anaesthesia below the groins, with relative sensory depression up to the tenth thoracic segment.

Lumbar manometry provided evidence of a complete spinal subarachnoid block and myelography demonstrated posterior disc protrusion at T10-11.

Exploration by the lateral approach revealed a rather resilient protrusion, and a degenerate hydropic nucleus pulposus was evacuated from the disc space with resulting recession of the bulge.

Post-operative progress was uneventful and neurological recovery steady. The patient was able to return to work as an oxyacetylene welder approximately five weeks after operation.

Operative Technique

The operation is conducted under general anaesthesia, using a cuffed endotracheal tube. It is important that the anaesthetist should be able to inflate the lung if the pleura should happen to be opened inadvertently as occasionally happens. The patient is placed prone, but supported so that a little lateral tilt away from the operator may safely be applied.

A paramedian incision corresponding to the outer border of the paravertebral muscle mass and centred at the level of the suspected disc space is used. The approach may be from either side, and the choice will depend upon the presence of lateralizing features. If unilateral root pains figure prominently in the history, the protrusion is likely to be greater on that side, which will therefore be preferred. In the absence of such indication, a left-sided approach has been employed.

The muscle layers are divided in the line of the incision until the outer border of the paravertebral muscles is exposed. These muscles are then reflected medially to expose the posterior aspects of the ribs, medial to the angles, and the tips of the transverse processes. Muscular branches of the posterior intercostal arteries require attention during this procedure.

The appropriate level is now confirmed by

palpation of the ribs, and portions of those on each side of the affected disc are resected. A length of about 5 cm. from the angle medially suffices. The pleura is next gently mobilized and reflected forwards and laterally, and the remaining portions of the heads and necks of the ribs are removed after dividing the costotransverse and capsular ligaments. This manoeuvre is facilitated by first nibbling away the tips of the corresponding transverse processes. The intervertebral foramen is identified by tracing the corresponding intercostal nerve medially, and its margins are defined. The foramen is enlarged by nibbling away portions of the pedicles until the lateral aspect of the theca is exposed.

The presence of a disc protrusion is confirmed by careful palpation with a flat, thin instrument anterior to the theca. Using a high-speed surgical burr, bone is excavated from the posterior aspects of the vertebral bodies beneath the base of the protrusion; the object is to create a hollow into which the latter can be withdrawn away from the theca, thus avoiding as far as possible any distortion or retraction of the cord. In some cases it is possible to cut right across the base of the protrusion, so that it can be withdrawn intact; in others it is removed piecemeal. In a few instances, in which the summit of the swelling was densely adherent, it has been necessary to resect a small portion of dura mater along with it.

The amount of bone removed is insufficient to endanger the stability of the spinal column, particularly as the laminae and interarticular joints remain intact.

The wound is closed in layers.

If the pleura has been opened, an intercostal catheter is inserted and connected to a water-seal bottle so that air may be expelled from the pleural space by expansion of the lung.

FIG. 4.—Operation sketch, illustrating the approach to the intervertebral foramen.

FIG. 5.—Diagram illustrating portions of bone removed (stippled).

FIG. 6.—The Desoutter high-speed grinder with surgical burr.

The use of a very high speed burr (up to 40,000 r.p.m.) greatly facilitates removing bone. This burr has the advantage that it does not “jump” or cause any detectable vibration. It can therefore be used with safety in close proximity to the theca. The instrument used is the Desoutter high-speed grinder driven by compressed nitrogen. The chuck is adapted to take a 3/32 Meisinger surgical burr. The tool is sterilized in dry heat at 160°C. for one hour.

Discussion

It is clear that this approach is appropriate only when an accurate pre-operative diagnosis has been established. The exposure of the theca is limited and inadequate for a more extensive exploration.

Although careful radiological studies, and particularly tomography, often reveal characteristic abnormalities such as calcification within the nucleus pulposus and posterior osteophytes, it has been considered essential to confirm the diagnosis and the level of the protrusion in every case by myelography. Considerable care, and sometimes repeated examinations, may be needed to obtain adequate visualization of the bulge when it is not causing a complete obstruction.

A valid theoretical objection to the operation is the risk of further endangering the blood supply of the cord by interruption of spinal arteries accompanying the intercostal nerves. An important

radicle often enters the longitudinal anastomosis in the lower thoracic region, and severing this might imperil the blood supply to a number of segments. This complication has not been encountered in any of the cases operated upon so far; care is taken, however, to avoid damaging the vessels accompanying the nerves.

Summary

An account is given of a lateral approach to posterior protrusions of the thoracic intervertebral discs. This approach has advantages over the standard laminectomy in allowing removal of the protrusion with minimal manipulation of the cord.

Six cases in which this method was employed are described.

I am greatly indebted to Mr. G. L. Alexander, surgeon in charge of the South Western Regional Neurosurgical Unit, for suggesting this method of approach to me, and for allowing me to include Case 6.

I am grateful to Mr. G. Francom, of the Department of Anatomy, University of Bristol, for Fig. 4.

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