A surgical approach through the pedicle to protruded thoracic discs

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Three cases of thoracic disc herniation presenting with signs of spinal cord compression are reported. The patients were operated on by an approach through a midline incision in which a pedicle is removed. Two patients were cured and one has improved.

KEY WORDS • thoracic intervertebral disc • spinal cord compression • intervertebral disc surgery

ONLY rarely do thoracic discs herniate and cause cord compression, as shown by the observation that they account for between 0.15% and 0.8% of all disc operations.1,14-16 Most thoracic disc protrusions occur in the lower four thoracic interspaces, the middle third ranks next, and least common are those in the upper thoracic spine.6 Sometimes a protruding thoracic disc compresses the cord acutely, perhaps after trauma, and produces root pain and immediate, severe, neurological symptoms, even a complete transverse myelitis. More often symptoms evolve slowly, beginning with a paraparesis that may progress to paraplegia unless properly diagnosed and given timely treatment.

In view of the well recognized difficulty of managing patients with ruptured thoracic disc, and because of the rarity of this problem, we wish to report three additional cases that were treated by a new surgical approach.

Surgical Technique

A linear, midline incision is made over the appropriate vertebrae, and the paravertebral muscles reflected from the spines and laminae on both sides. On one side the exposure must be beyond the facet joints. The facet joint and pedicle of the vertebra caudal to the protruded disc are removed with the air drill, for the most part using a cutting burr, but changing to a diamond burr when the dura mater is approached (Fig. 1). This creates a cavity as deep as the diameter of the spinal...
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canal, which seems surprisingly deep even though it may measure only 1.5 to 2 cm. The intervertebral disc space is entered next, and disc material is removed from the center of the disc (Fig. 2). After a cavity is created in the center, posterior disc material is removed, progressing from the lateral aspect below the root toward the midline under the spinal cord. A down-biting curette is helpful in this maneuver, and the curette can be hammered with a mallet to knock off posterior bone spurs.

After the cord is decompressed anteriorly, a laminectomy can be safely accomplished, starting laterally and moving medially across the midline to the opposite side (Fig. 3). Usually the dura need not be opened; however, if an intradural or an intramedullary fragment is suspected, the dura should be opened and the cord gently displaced to allow inspection of the anterior surface of the spinal cord and dura. This maneuver is not risky since the spinal cord is already adequately decompressed. We prefer to remove any intradural fragments under direct vision rather than to remove them blindly from the extradural space.

Case Reports

Case 1

A 39-year-old male basketball coach had experienced intermittent back pain for 5 years. One episode some months before surgery may have been associated with difficulty in walking. Five weeks prior to surgery numbness occurred in the right lower extremity. After 2½ weeks, walking became difficult and both knees occasionally buckled.

Examination. The patient reported a band-like constriction on the right thorax and upper abdomen; superficial pain, temperature, and vibration sense were found to be impaired in that region. The sensations of touch, position, vibration, and superficial pain were diminished in both feet. The right lower limb was spastic and weak with hyperactive tendon jerks and an extensor plantar response.

Spinal x-ray films showed advanced degenerative changes in the cervical and lumbar spine. A myelogram revealed a defect at the T1-2 interspace displacing the dural sac posteriorly and causing a partial obstruction to the flow of contrast agent. Cerebrospinal fluid (CSF) protein was 62 mg%.
prick and touch on the anterior thigh. Neurological recovery was rapid, and after 2 months the only abnormalities on examination were brisk tendon jerks and unsustained ankle clonus.

**Case 2**

Four months before admission, this 37-year-old woman first noticed the intermittent sensation of a band-like constriction around the right great toe. Soon thereafter a similar band-like sensation occurred around the waist. A month after the onset of symptoms she experienced difficulty in walking and climbing stairs. In the week before hospital admission urinary hesitancy and fecal incontinence developed.

**Examination.** She had a wide-based gait in which the right knee was held rigid and the hip was abducted to prevent the foot from dragging. Tendon reflexes were hyperactive in the lower limbs and the plantar responses were extensor. Appreciation of pinprick, light touch, and vibration were reduced below the waist on the right side. A myelogram showed an almost complete block at T8–9 due to an anteriorly placed mass; the CSF protein was 52 mg%.

**Operation.** The T8–9 disc was found to bulge posteriorly, but not enough to explain the symptoms of which the patient complained. Accordingly, the laminectomy was completed after an anterior decompression was performed. The dura was opened and the spinal cord appeared to be enlarged as if an intramedullary tumor were present. After the spinal cord was rotated, a fragment of disc material was found imbedded in the spinal cord in the right anterior quadrant, and removed. A hole in the dura could be seen, through which the fragment of the disc had migrated, causing, in effect, a right thoracic cordotomy.

**Postoperative Course.** The patient’s postoperative course was marked by rapid improvement in bladder and bowel function as well as clearing of the motor and sensory deficits.

**Case 3**

This 65-year-old man had an 8-week history of lower extremity weakness and numbness, and gait difficulty. Urinary retention prompted admission to the hospital where examination revealed impaired appreciation of pinprick, vibration, and position below T-11. The lower limbs displayed mild weakness with bilateral extensor plantar responses. On myelography an anterior epidural defect was found at T8–9 that proved at operation to be caused by a large, soft disc protrusion. The postoperative course was uneventful and motor strength and bladder function both improved. When the patient was last seen, the sensory level and extensor plantar responses were still present.

**Discussion**

The thoracic spinal cord has features that make it vulnerable to manipulation and trauma. In the first place, the spinal canal in the thoracic region is small and mostly occupied by the spinal cord with a minimal subarachnoid space. Second, the thoracic spinal cord has a tenuous blood supply, with the lower segments often dependent on a single artery, the arteria radicularis magna or artery of Adamkievicz. Third, thoracic discs tend to protrude not laterally but in the midline, and the protruded material is often hard, calcified, and may be adherent to the dura mater. Sometimes a fragment can penetrate the dura and become embedded in the cord, thereby simulating an intramedullary tumor as occurred in our second case. All these reasons, combined with the frequent difficulty of establishing the proper diagnosis, account for the unfortunate results of treatment that have sometimes been reported.

Probably the protruded disc damages the spinal cord through a combination of mechanical injury and vascular insufficiency. In animals, a decompression laminectomy alone, in the presence of an anterior epidural mass that obstructs the anterior spinal artery, always fails to restore normal spinal cord hemodynamics. Besides its effect on circulation, the anteriorly placed mass causes an axial tension in the spinal cord that increases with vertical distance and that may reach a critical degree on the posterior surface of the cord; decompressive laminectomy will not relieve this tension. Perhaps these experimental findings explain why the extent of the spinal cord injury is often out of all proportion to the size of protrusion, and also why laminectomy may be without benefit.
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| TABLE 1 |
| Summary of the results of various approaches in surgery for thoracic discs* |
| Result | Laminection | Trans-thoracic | Lateral Extrapleural |
| No. | % | No. | % | No. | % |
| cured | 29 | 32 | 6 | 75 | 28 | 61 |
| improved | 22 | 24 | 1 | 13 | 14 | 30 |
| not improved | 18 | 20 | 1 | 13 | 4 | 9 |
| paraplegic | 16 | 18 | -- | -- | -- | -- |
| died | 6 | 6 | -- | -- | -- | -- |

*Results summarized from references 2, 5-7, 12, 13, 19, 21.

or may even be hazardous. Laminectomy must be considered risky since 45% of reported patients treated by this method either deteriorated or derived no benefit from surgery.16,18,19

Since the risks of laminectomy for anteriorly placed masses in the thoracic region have been appreciated, other approaches have been devised that avoid manipulation of the spinal cord and yet allow removal of a mass. Of these, the most popular are the intrathoracic, transpleural approach and the lateral extrapleural approach.2,4,6,12,13,20 Besides the advantage of being extrapleural, the latter approach can be used even in the upper thoracic spine. However, a rib must be removed and it is usually necessary to ligate an intercostal artery. The posterolateral approach described by Jefferson13 combines a laminectomy with the partial removal of the transverse process, the pedicle, and the vertebral body through a T-shaped incision.13 We believe that the operation need not be as extensive as this, and that removal of the pedicle and part of the articular process through a midline linear incision provides sufficient room to remove the protruding disc safely. If laminectomy seems appropriate, it is easy enough to complete after removing the disc. As for the disc itself, some authors have recommended removal of the disc from the interspace only, without attempting to remove the protruded fragments.7 Others prefer removal of not only the central disc but also of osteophytes and any free fragments.5,18 Jefferson13 has suggested that when the protruded disc is firm one should drill into the vertebral body in order to create a space into which hard fragments of disc may be pulled away from the dural sac. We agree with this advice, and have found it feasible to accomplish with our approach through the pedicle. We stress the need for a careful search for disc fragments even by opening the dura, because sometimes a fragment may be embedded in the spinal cord. The risk that such a fragment may be overlooked appears greater with the transpleural, transthoracic approach, which is why we favor it least among the various lateral or oblique approaches. However, all these approaches have given better results than the old posterior approach (Table 1).

In addition to cases involving thoracic disc, the approach to the anterior aspect of the spinal canal in which part or all of a pedicle is removed has been helpful in some other circumstances. These include some cases of a cervical spondylitic ridge that compresses either a cervical nerve root or the spinal cord and also posttraumatic angulation of the spinal canal.

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