



Giant central lumbar disc herniations: a case for the transdural approach

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ABSTRACT

Giant central lumbar disc protrusions can pose a significant operative challenge. Clinically, these patients are at risk of permanent disability, due not only to preoperative neural compromise caused by the protrusion itself but also to the potential iatrogenic risks associated with the standard extradural microdiscectomy technique. This is the first report to date of a giant central L3/4 disc protrusion being successfully treated through a transdural microdiscectomy approach. Prior to this report, there have been just two cases describing its application in the lumbar spine. However, neither of these reports has described its use below the level of L2/3. We compare our surgical technique with these authors and discuss the pros and cons of this surgical approach relative to the standard extradural microdiscectomy technique. Overall, we have observed encouraging results from this approach and this report would support a role for further investigation into this rarely used technique.

KEYWORDS

Lumbar spine – Disc herniation – Discectomy – Transdural – Microdiscectomy

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Case history

A 67-year-old woman presented with a three-month history of progressively worsening bilateral L4 radicular pain, urinary hesitancy and long-standing lumbosacral back pain. Her pain had not responded to oral analgesics, physiotherapy or to facet joint injections. She had a positive femoral stretch test and a focal reduction in her knee extension power bilaterally (MRC grade 4–/5) with bilateral quadriplegic wasting.

Magnetic resonance imaging (MRI) revealed a voluminous central disc prolapse at L3/4 effacing her thecal sac (Fig 1). Following the MRI, she was admitted for a L3/4 discectomy. Given the size and location of her disc, a transdural approach was used.

With the patient in the prone position, a standard bilateral L3 and partial L4 laminectomy was performed. Hypertrophic ligamentum flavum was excised to reveal a dorsally displaced tense thecal sac. The location of the L3/4 disc space was confirmed with intraoperative fluoroscopy. Under the microscope, a 3-cm vertical median incision was made through the dura and arachnoid of the dorsal aspect of the thecal sac with its centre overlying the L3/4 disc space. The dura was tacked and the cauda equina rootlets were gently retracted. An intentional 1.5 cm vertical durotomy was made over the maximal bulge of the ventral dura. After meticulous dissection of dense adhesions between the disc herniation and the outer ventral dural sac, the prolapsed disc was incised, revealing soft disc material. The prolapsed disc

material was removed through the durotomy using a micro-rongeur and blunt hook until no further disc material was visible or palpable and the ventral sac appeared sufficiently decompressed (Fig 2).

The ventral dural wall of the thecal sac was then closed with interrupted 5-0 vicryl sutures. The dorsal dural wall of the thecal sac was closed with interrupted 5-0 vicryl sutures. Wound closure was completed in the standard fashion in three layers without the use of subfascial drainage. Postoperatively, the patient was restricted to flat bed rest for 72 hours and was then allowed to mobilise.

The patient made an excellent postoperative recovery with complete resolution of her leg and urinary symptoms within the first 72 hours postoperatively. Six months postoperatively, she continued to report complete resolution of her leg pain and urinary symptoms, normal lower limb power and an 80% reduction in her lumbosacral back pain. No operative complications have been reported to date.

Discussion

Giant central lumbar disc herniations can pose a significant challenge. Clinically, these patients are at risk of permanent disability preoperatively from neural compromise caused by the protrusion itself and from the potential iatrogenic risks associated with the standard extradural microdiscectomy technique.

The transdural discectomy approach is rarely used to resect extradural lumbar disc protrusions. To date, there

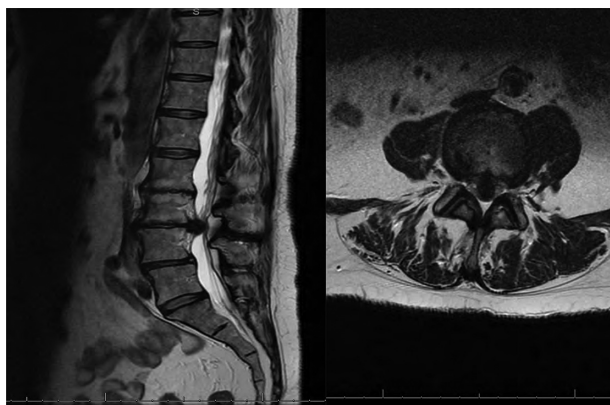


Figure 1 MRI Lumbar spine. T2-weighted sagittal MR image on the left shows the large L3/4 disc prolapse. T2-weighted axial MR image on the right shows the centrally located L3/4 disc prolapse compressing the cauda equina nerve roots

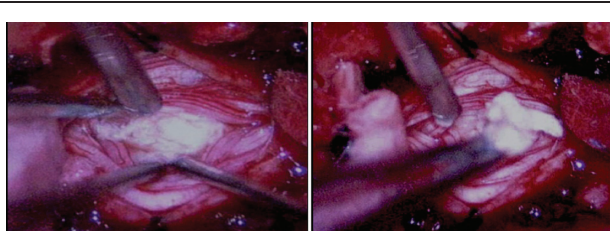


Figure 2 Transdural microdiscectomy. The photograph on the left shows the extradural disc material prior to removal following the ventral durotomy. The photograph on the right shows the removal of the disc material with the microrongeur

have been just two published case reports describing its use in the lumbar spine in a total of 15 patients.^{1,2} There are no systematic reviews or formal analyses of the technique. There have not been any contemporary publications describing its use below the level of L2/3. Table 1 summarises the techniques used and their outcomes.

Advantages of the transdural approach

Atraumatic visualisation

Central disc herniations can be awkward to access through a standard posterior extradural microdiscectomy approach, potentially requiring significant mobilisation of the exiting nerve roots to facilitate adequate exposure of the disc material. Protrusions can be particularly difficult to approach when they are very large, adherent to the ventral dura and/or calcified. A transdural approach allows clear access to and visualisation of the disc pathology, theoretically permitting an atraumatic discectomy. In the lumbar spine,

manipulation of the exiting nerve roots is not required and the risk of causing an unintentional ventral dural tear is reduced. In addition, there is also a reduced risk of bleeding, as the internal vertebral venous plexus is extradural and therefore outside the surgical field, improving visualisation during the procedure and reducing the risk of a post-operative haematoma.⁵

Limited resection

Our patient had a very large central disc protrusion. Usually in our institution, a full laminectomy would be favoured to ensure sufficient exposure and hence facilitate a safe discectomy in a disc of this size. If a posterior extradural approach were to be attempted to obtain adequate exposure, a more extensive lateral bony resection would likely be required (for example, a medial facetectomy). As the transdural approach only requires a laminectomy, sometimes even just a hemilaminectomy, it potentially allows a more limited dissection and resection, keeping the patient's postoperative pain to a minimum and maintaining the integrity of the facet-pedicle complex.^{5,4}

Familiar surgical technique

The transdural approach has also been advocated as a familiar surgical technique that can be readily adopted by spinal surgeons who are comfortable with performing a laminectomy and performing intradural surgery, with no requirement for additional instrumentation.⁴

Disadvantages of the transdural approach

Iatrogenic neural injury

Once the thecal sac has been opened, the cauda equina nerve rootlets are more vulnerable to iatrogenic injury. This has to be counterbalanced against the risk of iatrogenic neural injury during the mobilisation of the exiting nerve roots during an extradural discectomy. Among the 15 cases that have been reviewed in published case series of transdural discectomies, iatrogenic neural palsy has been reported in just one case, which improved without the need for further surgical intervention.

Leak of cerebrospinal fluid and arachnoiditis

As with any intradural procedure, the required durotomies place the patient at risk of a postoperative cerebrospinal fluid (CSF) leak if the durotomy fails to heal. A persistent CSF leak can be associated with the formation of a pseudomeningocele, failure of the surgical wound to heal and the risk of low intracranial pressure. There is also a theoretical risk of the patient developing arachnoiditis once the dura has been opened. Among the 15 cases reviewed in published case reports of transdural discectomies, there were no reports of these complications.^{1,2} It should be noted that even with a standard extradural approach, the risk of an inadvertent dural tear occurring in a patient with a large, central disc protrusion is heightened due to the inherent technical challenge of the procedure, particularly when the disc protrusion adheres to the ventral dura.

Table 1 Previous publications on transdural discectomy approaches within the lumbar spine.

Authors	Patients (n)	Surgical technique	Pathology treated	Outcome	Mean follow-up (months)	Complications
Choi <i>et al.</i> , 2007 ¹	4	Laminectomy or laminotomy. Dorsal and ventral durotomies. Microdiscectomy. Durotomies closed with synthetic tissue substitute which was fixed with fibrin glue	L1/2 calcified central disc protrusions	Improved (n = 4)	53	Temporary neural palsy (n = 1)
Kim <i>et al.</i> 2010 ²	11	Laminectomy (n = 10); hemilaminectomy (n = 1). Dorsal and ventral durotomy. Microdiscectomy. Durotomy closure not stated.	L1/2 and L2/3 broad-based large central disc protrusions	Improved (n = 10); did not improve: established cauda equina syndrome preoperatively (n = 1)	16.6 (3–120.8 months)	Nil reported

Postoperative mobility restrictions

It is important to consider the inherent disadvantage of the patient remaining supine for 72 hours postoperatively. This restriction heightens the risk of postoperative medical complications – for example, venous thromboembolism. Appropriate preventative steps (for example, mechanical and chemical prophylaxis) need to be taken to keep these risks to a minimum. It is important to note that not all spinal surgeons advocate bed rest following intradural procedures and the application of this restriction is not an absolute requirement but rather a decision made by the operating surgeon on a case-by-case basis.

Comparing transdural discectomy techniques

We have compared the way in which we performed our procedure relative to previously published reports of the lumbar transdural approach (Table 1). In all reported cases, including our own, the dura was accessed via a laminectomy or laminotomy. A dorsal midline durotomy was sited through the thecal sac. A transradicular approach was not used. A transdural discectomy was then performed under the microscope following the ventral durotomy.^{1,2} The main difference in surgical technique related to the surgeon's choice of dural closure.

The choice of whether the ventral dural defect should be closed or not relates to its size and relationship to surrounding structures. We chose to close the defect due to concerns that cauda equina rootlets could potentially herniate into the cavity of the defect resulting in neurological morbidity. We closed it with absorbable sutures, not synthetic materials, to reduce the risk of arachnoiditis. In contrast, Choi *et al.*¹ closed their dural defects with a synthetic tissue substitute that was then fixed with fibrin glue. For the dorsal durotomy, Choi *et al.*¹ again advocated the use of synthetic products to supplement dorsal dural closure (for example, fibrin glue).

We did not use these products but relied on vicryl sutures alone because of our aforementioned concerns regarding arachnoiditis.

Familiarity of the transdural approach for the spinal surgeon

To perform the transdural approach described in this case report, the surgeon needs to be familiar with performing intradural operations. A spinal surgeon who has completed neurosurgical specialist training in the UK will have performed intradural procedures as part of their training. However, this is less likely to be the case for spinal surgeons from an orthopaedic background, inadvertently limiting the application of the transdural approach.

Orthopaedic surgeons play a key role in the provision of UK spinal surgery, with spinal surgery currently comprising 14% of orthopaedic practice and the 2016 General Medical Council national survey identifying that 7.95% of year 6–8 orthopaedic specialty trainees wished to pursue a career in spinal surgery.⁵ Providing adequate opportunities for these trainees to appropriately develop their skill-set is essential, particularly as their exposure to spinal surgery during their six-year specialist training is generally limited to a maximum of six months.

In April 2017, the national Spinal Interface Group Proposal was published.⁵ This proposal was co-authored by the neurosurgical and orthopaedic spinal communities in the UK and represented their collective views regarding the way forward for training spinal surgeons. To tackle the limitations of the current training programs, they supported the role of post-Certificate of Completion of Training (CCT) fellowships in spinal surgery, for example a cross-training fellowship – where an orthopaedic trainee could complete a fellowship within a neurosurgical spinal unit, developing their understanding of the neurosurgical approach to spinal

surgery and giving them the opportunity to participate in procedures which are not standardly performed by orthopaedic spinal surgeons, for example intradural operations.

This scheme is further supported by statistically significant improvements having been noted in the competency levels of spinal surgeons who have completed one-year spinal fellowships post-CCT relative to those who have not.⁶ Our case would lend further support to this proposal, with a view to not only developing orthopaedic trainees' operative exposure to procedures such as intradural operations but also their confidence in dealing with recognised spinal surgical complications, for example an unintentional durotomy.

Conclusion

We have explored the role of this controversial approach in a patient with a giant, central, adherent L3/4 disc protrusion and would advocate that there is a role for further research into this technique. Our limited case review

would support its role as an additional tool in the spinal surgeon's armamentarium for approaching substantial centrally-based lumbar disc protrusions.

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