Transforaminal endoscopic decompression of a postoperative dislocated bone fragment after a 2-level lumbar total disc replacement: case report

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The proposed advantages of total disc replacement (TDR) over fusion in the lumbar spine are the preservation of motion and the avoidance of adjacent-level disease. One of the complications inherent in TDR is the possibility of vertebral body fracture due to trauma or a malpositioned implant. The resulting dilemma is that posterior decompression of the displaced bone fragment could then have a destabilizing effect and possibly require fusion, thus obviating the benefit of an arthroplasty procedure. In this study, the authors describe the technical considerations and feasibility of the treatment of a postoperative L-5 paresis that resulted from a dislocated bone fragment at L4–5 during a 2-level lumbar TDR.

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LUMBAR artificial total disc replacement (TDR) (also known as lumbar intervertebral disc prosthesis or lumbar total disc arthroplasty) is considered for the treatment of symptomatic lumbosacral degenerative disc disease in skeletally mature patients in whom conservative treatment has failed and who do not have significant joint degeneration, osteopenia/osteoporosis, or severe instability.^{2,22,23} Early complications of the procedure include problems with initial implant positioning or, in rare cases, the implant can fracture the vertebra upon insertion or the vertebra can fracture during the postoperative period.^{1,5,7,18,19,22,23} If this occurs, revision surgery with possible conversion to a spinal fusion may be needed.^{4,6,8,10–12}

The performance of lumbar TDR underwent a surge in the US and then a decline, due mostly to problems with insurance approval. The US FDA has only approved implantation of lumbar TDR for 1-level cases between L-3 and S-1.²² Patients in the US seeking multilevel lumbar TDR leave the country and usually travel to Germany (where the first Charité artificial disc was implanted in 1984)⁹ for treatment in which a 1- to 4-level lumbar TDR is performed.

Transforaminal lumbar endoscopic surgery is a minimally invasive surgical approach to lumbar spine pathology that has been previously described as a novel “rescue” surgery for patients with persistent lumbar nerve

root compression after transforaminal lumbar interbody fusion,^{14,15} lumbar instrumented fusion,¹⁶ and other lumbar decompressive surgery.²¹ Herein, we present the case of a patient with an acute L-5 paresis after an L4–S1 TDR, complicated by a retropulsed bone fragment in the neural foramina and treated successfully with transforaminal endoscopic surgery.

Case Report

History and Presentation

A 40-year-old woman presented with a > 3-year history of low-back pain despite conservative treatment with physical therapy and interventional pain management. Preoperative lumbar MRI demonstrated a decreased T2 signal at the L4–5 and L5–S1 levels, with only mild loss of disc height. The preoperative visual analog scale back score was 7/10, with no symptoms radiating to the legs and no deficits on neurological examination. She underwent an L4–S1 2-level TDR (LP-ESP; FH Orthopedics). Three hours after the surgery, she developed a right foot drop. An emergency lumbar CT scan was performed, revealing a slightly lateralized position of the L4–5 implant and a large bone fragment of the inferior posterior L-4 vertebral body in the right neural foramen (Fig. 1).

ABBREVIATIONS TDR = total disc replacement.

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FIG. 1. CT scans obtained after L4–S1 TDR. Sagittal CT reconstruction shows a fragment of the inferior portion of the body of L-4 retropulsed into the right neural foramen (**A**). Axial CT shows the TDR implant positioned slightly to the right of L4–5 (**B**). Coronal CT reconstruction shows slight misalignment of the L4–5 TDR implant and the bone fracture of the inferior portion of the L-4 vertebral body (**C**).

Operation

For the surgery to decompress the retropulsed bone fragment in the right L4–5 foramen, general anesthesia was induced and the patient was placed prone on the Wilson frame. The joimax TESSYS endoscopic system was used for the procedure. Percutaneous entry was established, entering through the skin 11 cm lateral to the midline. Using intermittent fluoroscopic guidance, alternating between lateral and anteroposterior views, a 25-cm 18-gauge needle was advanced and placed in the disc space through Kambin's triangle, between the exiting and traversing nerves. An anteroposterior fluoroscopic view was used to ensure that the disc space was entered before the needle was inserted beyond the medial wall of the pedicle.

Sequential reamers were used to enlarge the neural foramen by removing the ventral aspect of the superior articulating process (Fig. 2). Resection of the bone fragment and decompression of the neural foramen were then performed. Figure 3A and Video 1 depict identification of the bone fragment. Figure 3B and Video 2 depict seg-

mentation of the bone fragment with the diamond drill. Figure 3C and Video 3 depict resection of the bone fragment with the down-biting grasper. Figure 3D and Video 4 depict resection of the posterior ligament with the grasper and exposure of the TDR implant. Figure 3E and Video 5 depict the endoscopic view of the neural foramen after decompression; the exiting and traversing nerve roots can be visualized. The disc and bone fragments removed are shown in Fig. 4.

VIDEO 1. Clip showing identification of the bone fragment. Copyright Albert E. Telfeian. Published with permission. [Click here to view.](#)

VIDEO 2. Clip showing segmentation of the bone fragment with the diamond drill. Copyright Albert E. Telfeian. Published with permission. [Click here to view.](#)

VIDEO 3. Clip showing resection of the bone fragment with the down-biting grasper. Copyright Albert E. Telfeian. Published with permission. [Click here to view.](#)

VIDEO 4. Clip showing resection of the posterior ligament with the grasper and exposure of the TDR implant. Copyright Albert E. Telfeian. Published with permission. [Click here to view.](#)

FIG. 2. Lateral fluoroscopic radiographic views of access to the right L4–5 neural foramen. The Seldinger approach was used, with sequential dilators placed down to the foramen (**left**). Sequential reamers were used to remove a portion of the ventral aspect of the superior articulating process of L-5 to allow endoscopic visualization of the right L4–5 foramen (**right**).

FIG. 3. Endoscopic resection of the retropulsed bone fragment and decompression of the neural foramen. **A:** Identification of the bone fragment. (See also Video 1.) **B:** Segmentation of the bone fragment with the diamond drill. (See also Video 2.) **C:** Resection of the bone fragment with the down-biting grasper. (See also Video 3.) **D:** Resection of the posterior ligament with the grasper and exposure of the TDR implant. (See also Video 4.) **E:** Endoscopic view of the neural foramen after decompression; the exiting and traversing nerve roots can be visualized. (See also Video 5.)

VIDEO 5. Clip showing the endoscopic view of the neural foramen after decompression; the exiting and traversing nerve roots can be visualized. Copyright Albert E. Telfeian. Published with permission. Click here to view.

Postoperative Course

At the termination of the procedure, the working channel and scope were removed, pressure was held on the 5-mm incision for 5 minutes, and the wound was closed with a single interrupted suture. Immediately after the procedure, the patient's foot dorsiflexion paresis improved and her foot strength was completely normal by the next day. One year after her 2-level TDR, she described her result as "excellent."

Discussion

The most frequent early complications associated with lumbar TDR include device anterior migration, sizing and malpositioning errors, and posterior element fracture. Together, these occur with an incidence between 1% and 2%.^{1,5,7,18,19} Other studies have shown that endoscopic spine surgery is an effective procedure for treating multiple pathologies in the lumbar spine, including lateral, paracentral, central, extruded, and even contralateral herniated discs, as well as lateral recess stenosis.^{3,13,17,20} The success of treating lumbar radicular symptoms in the setting of spinal instrumentation has also recently been published.^{14–16}

Herein, we describe the first published case of a transforaminal endoscopic procedure used to successfully treat the complication of a vertebral body fracture after lumbar TDR, resulting in symptomatic foraminal compromise. The technology and access route involved in transforaminal endoscopic surgery are ideally suited to treat this particular complication, which is inherent to TDR device placement. The point of TDR is to preserve spinal motion while eliminating discogenic back pain. Preserved spinal stability with intact posterior spinal elements is considered necessary for successful TDR. Unfortunately, surgical treatment for complications of TDR, whether they are through an anterior, posterior, or extreme lateral approach, usually result in a fusion of the previously treated arthroplasty level.^{4,6,8,10–12}

The transforaminal route and minimally invasive endoscopic technique offer the advantage of a route and access that allows the foramen to be decompressed (even if the compressive element is a rather large bone fragment)

without destabilizing the motion segment. The surgical instruments available today for endoscopic spine surgery (i.e., reamers, drills, graspers, electrocautery, ball probes, and nerve hooks) do, for the most part, mirror those available for open spine surgical procedures. The case presented here is intended to provide the community of spine surgeons with increased awareness of the possibilities of endoscopic approaches, not just for primary pathology but also for so-called rescue or revision surgical approaches.

Although more and more spine pathologies are being treated with endoscopic minimally invasive techniques, it is worth mentioning the potential pitfalls of endoscopic spine surgery, which include a difficult learning curve, small instruments and drills, and the challenges of targeting the pathology. This single case report represents a successful acute surgical rescue procedure for a TDR complication. However, a larger series would have to be examined to address long-term sequelae after such a procedure. These could include restenosis, possible heterotopic ossification secondary to drilling, and impact on mechanical function of the arthroplasty prosthesis.

Most of the major health insurance carriers in the US (including UnitedHealth, Aetna, Humana, and most Blue Cross Blue Shield affiliates) do not provide coverage for single-level lumbar TDR. The most common explanation

FIG. 4. Bone and disc fragments that were removed in the endoscopic decompression of the right L4–5 foramen.

is that the technology is considered investigational, despite the fact that studies involving 1 level have demonstrated decreased adjacent-level disease, minimal component-wear issues, and lower revision rates than fusion. Patients seeking a lumbar TDR option travel abroad (often to Germany), seeking evaluation and possible surgical treatment. Spine surgeons worldwide should be prepared to treat the complications that patients may suffer following lumbar TDR. In this study, we present a unique, minimally invasive, nondestabilizing treatment for a complication that could be recognized early or late after a lumbar TDR.

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Disclosures

Dr. Ipreburg received payments from joimax for teaching.

Author Contributions

Conception and design: all authors. Acquisition of data: Wagner. Analysis and interpretation of data: all authors. Drafting the article: all authors. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Telfeian. Administrative/technical/material support: all authors. Study supervision: all authors.

Supplemental Information

Videos

Video 1. <https://vimeo.com/148102872>.

Video 2. <https://vimeo.com/148102874>.

Video 3. <https://vimeo.com/148102873>.

Video 4. <https://vimeo.com/148102875>.

Video 5. <https://vimeo.com/148102871>.

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