

Case Report

Percutaneous Endoscopic Lumbar Discectomy for Far-Migrated Disc Herniation through Two Working Channels

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The technique of percutaneous endoscopic lumbar discectomy (PELD) in the transforaminal approach has evolved over the years due to the advances in endoscopic photology and instrumentation and become the most popular technique for lumbar disc herniation. Although PELD offers many advantages, the indications of PELD are limited mostly to non-migrated or low-migrated disc herniation. It is very difficult for PELD in the transforaminal approach to remove the highly migrated disc fragment successfully due to the anatomic barrier. Nowadays, with the advances of instruments and technique, it might be possible for PELD in the transforaminal approach to remove these high-grade migrated disc fragments. The purpose of this study was to describe a technique to effectively treat highly migrated disc herniation via 2 working channels.

Key words: Percutaneous endoscopic lumbar discectomy, far-migrated disc herniation, working channels

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In 1973, Kambin introduced the concept of percutaneous posterolateral nucleotomy for a protruded disc and Hijikata described the first percutaneous discectomy in 1975 (1,2). Since then, the technique of percutaneous endoscopic lumbar discectomy (PELD) in the transforaminal approach has evolved over years due to the advances in endoscopic photology and instrumentation and become the most popular technique for lumbar disc herniation.

Compared with conventional open surgery, PELD has a lot of merits such as normal paraspinal structures preservation, minimal postoperative pain, and lower risk of postoperative epidural scar formation and iatrogenic instability (3-6). Although PELD offers many advantages, the indications for PELD are limited mostly to non-migrated or low-migrated disc herniation. It is very difficult for PELD in the transforaminal approach to remove the highly migrated disc fragments successfully due to the anatomic barrier (7,8), which accounts for the major cause of postoperative remnant disc materials. Nowadays, with

the advancement of instruments and technique, it might be possible for PELD in the transforaminal approach to remove these high-grade migrated disc fragments.

The purpose of this study was to describe a technique to effectively treat highly migrated disc herniation via 2 working channels.

CASE REPORT

A 66-year-old woman was admitted to our hospital due to low back pain for 10 years, as well as left lower extremity pain and numbness for 3 months. The patient had lower back pain and discomfort for 10 years, but the symptoms were relieved after the break. She received intermittent physiotherapy, acupuncture, and other symptomatic treatment for a while. Three months ago, the patient began to feel pain in the left lower limb with numbness, mainly in the groin, front thigh, and medial calf which got worse after activities.

Preoperative physical examination demonstrated positive straight leg raising test for left leg (30°) and

positive intensification test. There was hypoesthesia on the left lower limb, mainly in the groin and front side of the thigh. The right lower limb had normal muscle force, but the left lower limb of the quadriceps was grade III. Left knee reflex was reduced, but right knee reflex and bilateral Achilles tendon reflexes were normal. Bilateral pathological reflex was not elicited. Preoperative back visual analog scale (VAS) score was 4 points, while left leg VAS score was 9 points. Preoperative lateral lumbar spine examination revealed degenerative spinal scoliosis, lumbar 5 sacralization, L3/4 vertebral instability, and L1 vertebral wedge changes (Fig. 1A, B). Preoperative magnetic resonance imaging (MRI) revealed L3/4 spondylolisthesis and L3/4 central disc herniation on the partial left side, as well as L3/4 disc prolapse with nucleus shifting upwards to L2/3 intervertebral space (Fig. 1C, D).

The patient was placed prone on the operating table, and C-arm fluoroscopy was used to confirm the target segment. We used a self-developed surface locator to conduct preoperative localization to confirm lumbar spinous process, L2, L3, L4 pedicles, target position, and intervertebral space. We also marked the intervertebral foramen position on the body surface (Fig.

2A). The surgical puncture point was 10 cm from the midline for the L3/4 segments and 8 cm from midline for the L2/3 segment. The puncture path was deviated to the cranial direction for the L3/4 segment and deviated to the caudal direction for the L2/3 segment. Routine disinfection and shop towels were used. Lidocaine (1%) was used to conduct the local anesthesia through the puncture path with the L3/4 free disc as a target. An 18G needle was used to reach the L3/4 intervertebral foramen. Anterior fluoroscopy confirmed the needle position on the edge connections of the pedicle. Lateral fluoroscopy confirmed the needle position above the vertebral foramen (Fig. 2B, C). The working channel was then placed into the intervertebral foramen, and intraoperative fluoroscopy displayed the working channel completely placed diagonally on the spinal canal (Fig. 2D, E). Endoscopy was used and the yellow ligament was isolated to reveal the top free nucleus pulposus. Curved forceps were used to remove the free nucleus pulposus at the L3 level, having been placed at the L3 vertebral body edge (Fig. 2F, G). The working channel was rotated downward to process the L3/4 herniated disc, and the L4 nerve root and lateral recess area were fully exposed (Fig. 2H). The working channel was again

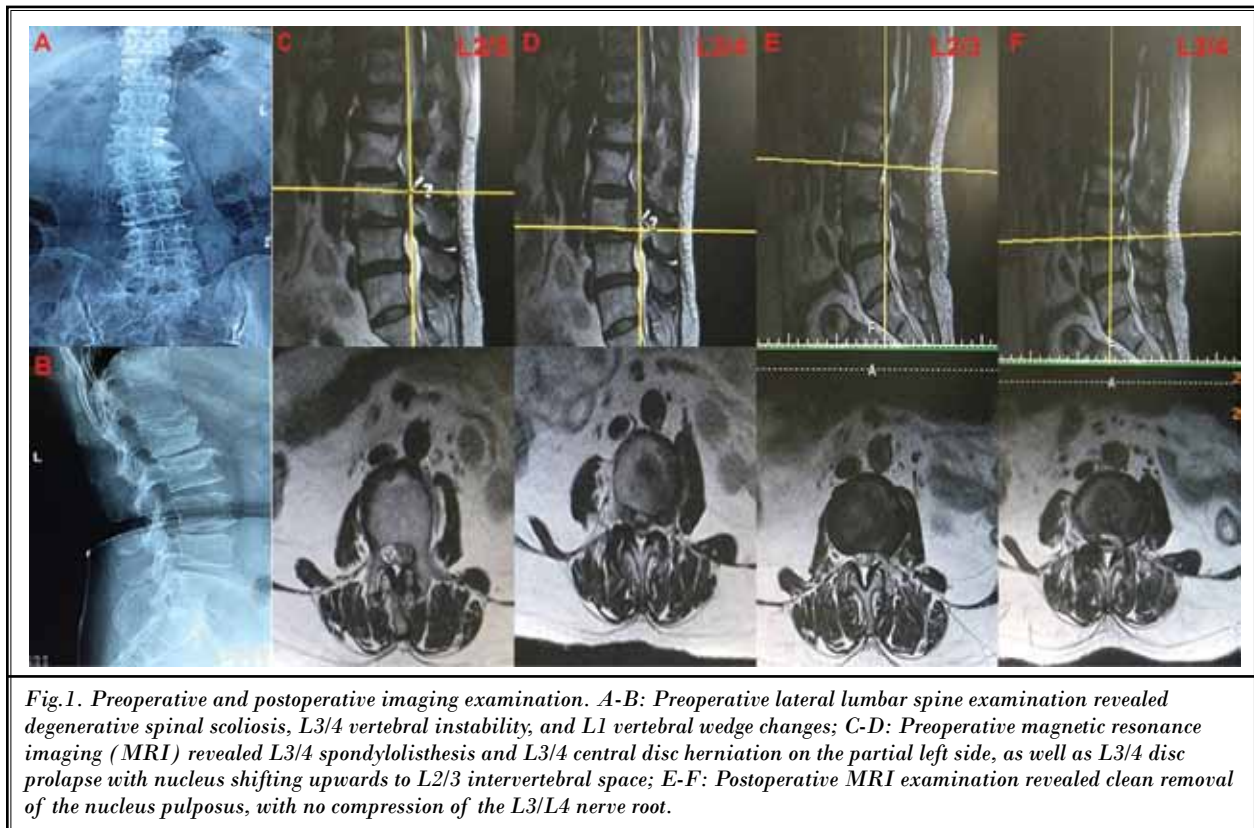


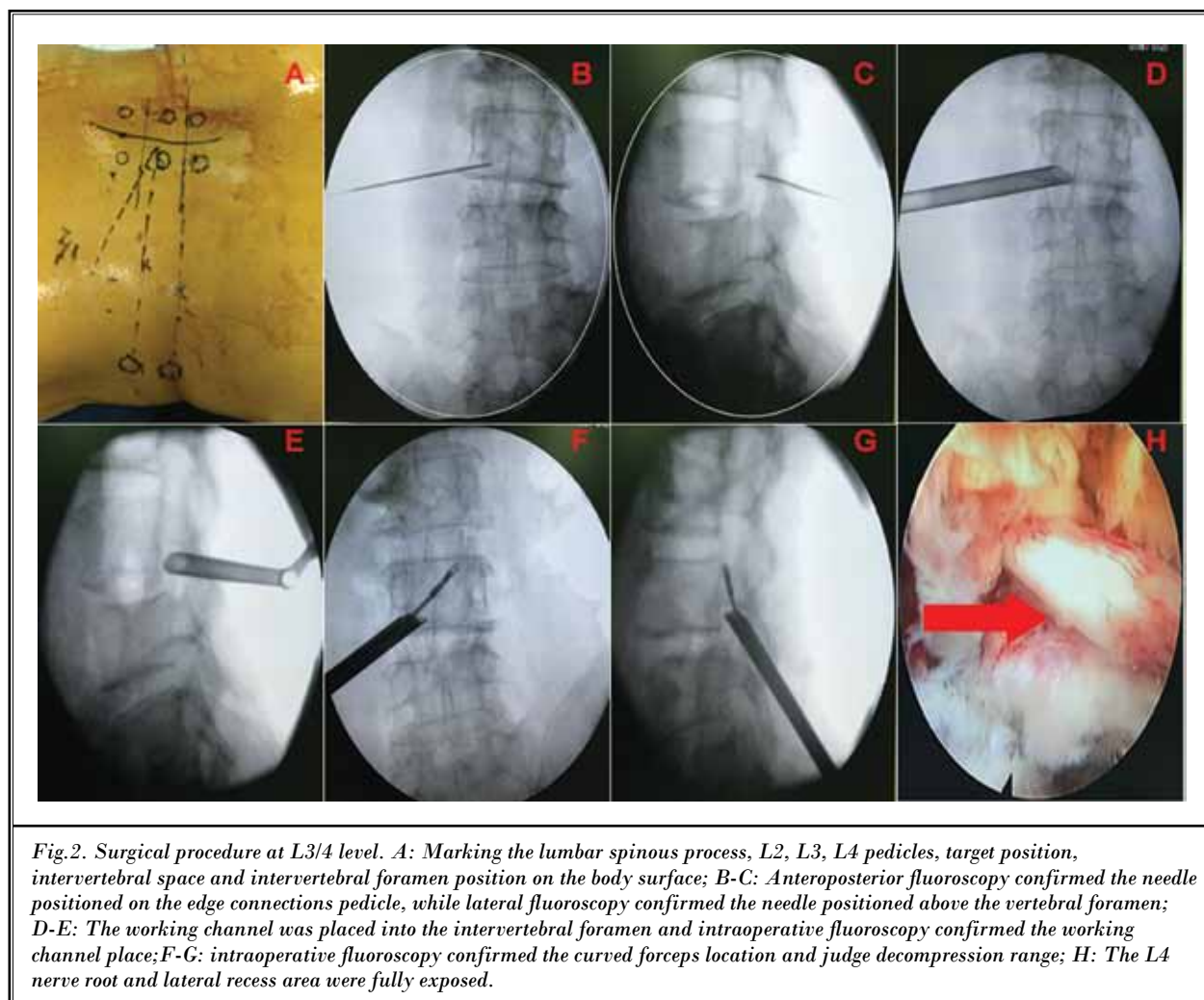
Fig. 1. Preoperative and postoperative imaging examination. A-B: Preoperative lateral lumbar spine examination revealed degenerative spinal scoliosis, L3/4 vertebral instability, and L1 vertebral wedge changes; C-D: Preoperative magnetic resonance imaging (MRI) revealed L3/4 spondylolisthesis and L3/4 central disc herniation on the partial left side, as well as L3/4 disc prolapse with nucleus shifting upwards to L2/3 intervertebral space; E-F: Postoperative MRI examination revealed clean removal of the nucleus pulposus, with no compression of the L3/L4 nerve root.

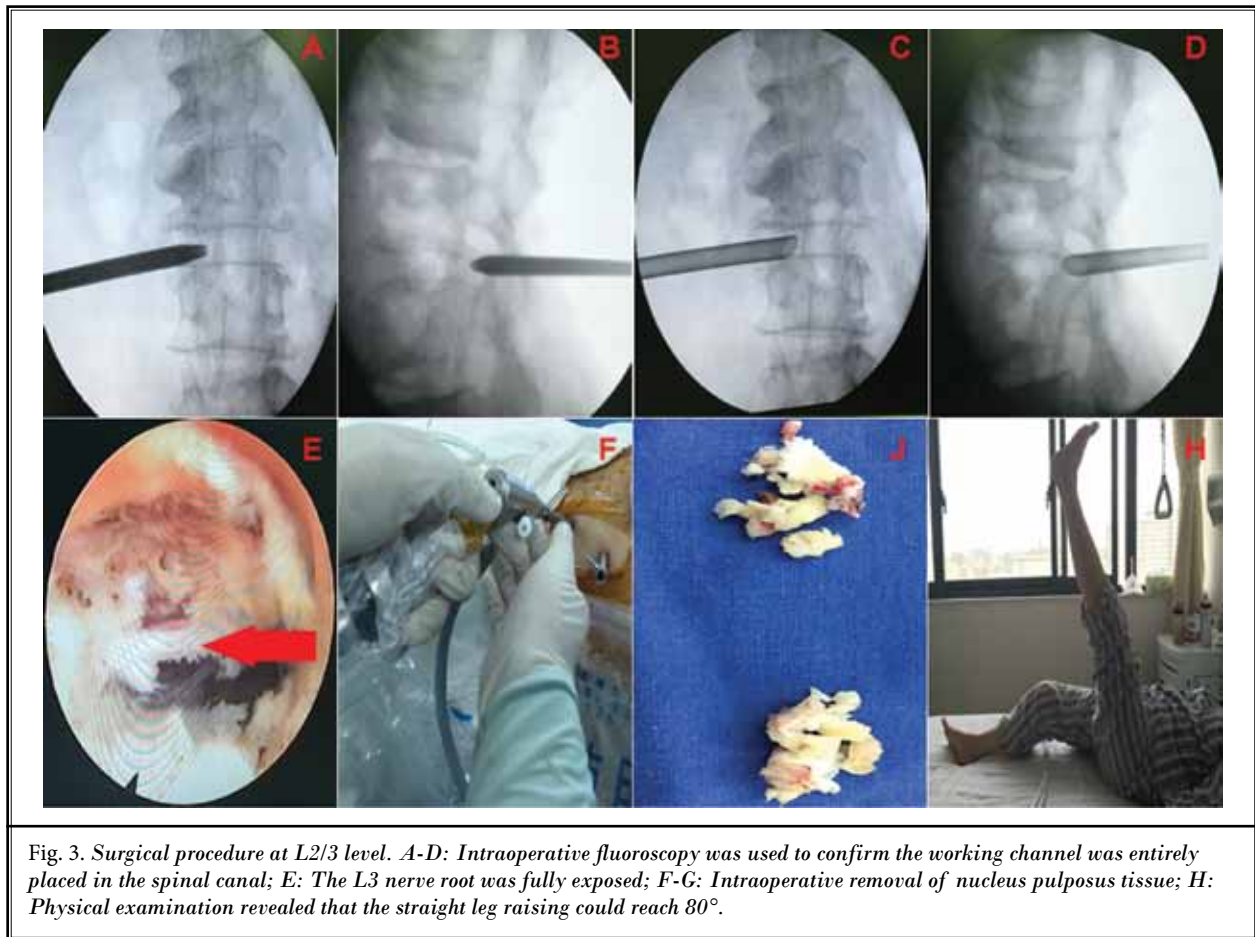
rotated outwardly to confirm no obvious L3 nerve root compression. To prevent the free nucleus from shifting away, the L3/4 working channel was changed into the flat-end working channel.

Lidocaine (1%) was used to conduct the local anesthesia through the puncture path. An 18G needle was localized to the L2/3 intervertebral foramen under fluoroscopy, followed by the working channels slanted downwards into the foramen. Intraoperative fluoroscopy was used to confirm the working channel was entirely placed in the spinal canal (Fig. 3A, B, C, D). The endoscopy was then placed, and the prominent free residual nucleus pulposus could be seen located below the L3 nerve root. Curved forceps were used to bite the herniated nucleus pulposus tissue, until there were no L3 nerve root compressions (Fig. 3E).

After debriding the L2/3 intervertebral space, we re-entered the L3/4 working channel to check the L3 vertebral posterior. Residual free nucleus remained below the pedicle, and was removed by curved forceps. Finally, we reconfirmed that there were no further remnants via the 2 channels, and flushed the disc space with saline containing gentamicin. The incision was sutured after the working channel was removed.

The postoperative leg pain symptoms were relieved significantly to one on the VAS of the lower extremity. The VAS score for back pain was one as well. Physical examination revealed that the straight leg raising could reach 80° (Fig. 3H). The lumbar spine MRI examination revealed clean removal of the nucleus pulposus, with no compression of the L3/L4 nerve root (Fig. 1E, F).





Discussion

PELD in the transforaminal approach for highly migrated disc herniation is still challenging even for experienced surgeons. In 2006, Lee et al (8) showed that a satisfactory outcome was obtained in 78.9% (30/38) of the patients with highly migrated disc herniation with the percutaneous endoscopic transforaminal lumbar discectomy technique. Lee et al (8) recommended that open surgery should be considered for far-migrated disc herniations. But the open discectomy, such as paramedian Wiltse approach hemilaminotomy, need extensive resection of the lamina especially in the region of the pars interarticularis and facets. This may result in iatrogenic instability and increasing postoperative morbidity. In the presented case, the x-ray radiography revealed instability of the L3/4 segment. Therefore, it would be inappropriate to conduct laminectomy unless we added screws, which would increase the cost for the patient.

With the development of instruments and technique in the past decade, the indications for PELD were constantly expanding and achieved favorable clinical outcomes. Choi et al (9) presented the foraminoplasty technique for highly migrated intracanal lumbar disc herniations using an endoscopic drill and laser. Part of the superior facet and superior margin of the pedicle of the inferior vertebra were removed for down-migrated herniation. A successful outcome was achieved in 91.4% of the patients during the 25-month follow-up. Kim et al (10) also showed a similar foraminoplasty technique for highly down-migrated disc herniations with favorable clinical outcome in 94% of the patients (50/53). Yeom et al (11) introduced PELD in a contralateral transforaminal approach for distally migrated disc herniation and the clinical results were excellent in 10 patients (10/12) and good in 2 (2/12) according to MacNab criteria. Similarly, we used 2 working channels to achieve favorable outcomes with postoperative symptoms completely improved. The preoperative back

VAS score was 4 points, while left leg VAS score was 9 points, and left leg straight leg raising test was 30°. However, postoperative lumbar VAS score became one point, while left lower VAS score was one point, and straight leg raising test was up to 80°. After review of MRI, the herniated disc was completely removed.

Although these techniques were excellent and the result of the operation was more outstanding compared to the first report by Lee et al (8), these techniques might have potential risk of disc residue. According to the study by Choi et al (9), 3 of the 59 patients (about 5%) failed to have symptom relief due to arterial disc remnants and disc material remnants were present in 13% (7/53) in the study by Kim et al (10). The failure might be due to the characteristic of highly migrated disc herniation. The highly migrated discs were sometimes multi-fragmented and easily snapped off during pulling of the disc material (12). Multi-fragmented disc material was observed in 11 of 18 (about 61%) patients in the study by Kim et al (13). Therefore, those fragmented herniations could not be completely removed just by grasping the proximal part of the herniation. Besides, there were some small pieces of migrated disc located in the pedicle and we couldn't see it through the endoscope due to anatomic barriers. Those problems were the major cause of post-operative remnant disc materials. In this paper, we used 2 working channels to confirm whether there was remnant disc material. The advantage of this setting was that when the disc debris shifted away, we could remove it

from the other channel. This procedure would reduce the incidence of postoperative residual disc material.

The advantages of the standard open surgery over endoscopic discectomy for highly migrated disc herniation are the direct approach to the distal end of the migrated fragment and less risk of disc residue. However, compared with the conventional open surgery, PELD offers several advantages such as normal paraspinous structures preservation, minimal postoperative pain, and lower risk of postoperative epidural scar formation and iatrogenic instability. For some elderly patients and patients with lumbar spondylolisthesis, PELD could be a viable alternative.

CONCLUSION

PELD in the transforaminal approach via 2 working channels is a safe and effective procedure for highly migrated disc herniation. It could be a viable alternative to conventional open surgery because a direct approach to the migrated herniation is possible with this technique.

Disclaimer

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