Case Report

A Novel Combination of Percutaneous Endoscopic Lumbar Discectomy and Epiduroscopic Laser Neural Decompression for Down-migrated Disc Herniation

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Although percutaneous endoscopic lumbar discectomy (PELD) is an effective treatment for herniated discs, its application in a disc with extensive migration is still challenging. As such, epiduroscopic laser neural decompression (ELND) provides a new view of the epidural space as well as an alternative treatment for a herniated disc and epidural fibrosis. In this paper the authors introduce the novel combination of PELD and ELND for high grade down-migrated disc herniation.

An 87-year old woman presented with severe pain radiating down her leg due to high grade down-migrated disc herniation at L4-5. The therapeutic plan was organized into 3 steps. First, the patient underwent PELD to remove the paracentral extruded disc and open the epidural space between the traversing nerve root and disc space. Second, ELND was performed to remove the down-migrated disc and simultaneously push the free fragment to the L4-5 disc space. Lastly, repetitive free fragments were picked up and streamed upward using ELND. The patient reported significant reduction of pain after surgery. Postoperative magnetic resonance imaging (MRI) showed complete removal of the ruptured disc fragment.

A combination of PELD and ELND may be an option of treatments for down-migrated disc herniation.

Key words: Percutaneous endoscopic lumbar discectomy, epiduroscopic laser neural decompression, down-migrated disc herniation

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Percutaneous endoscopic lumbar discectomy (PELD) is a minimally invasive spinal technique that has several advantages over open discectomy, including less paravertebral muscle injury, preservation of bony structure, and rapid recovery (1). Although PELD has gained in popularity with the evolution of endoscopic techniques and instrumentation, a down-migrated disc is still regarded as inaccessible by rigid instrumentation due to poor visualization and limited accessibility (2,3).

Epiduroscopic laser neural decompression (ELND) was recently introduced for visualization of the epidural space and direct treatment of herniated discs, adhesions, or fibrosis using a laser. ELND can be applicable in lumbar disc herniation, spinal stenosis, and post lumbar surgery syndrome (4-6).

In this paper, the combined application of PELD and ELND for high grade down-migrated disc herniation is first introduced.

Case Report

An 87-year-old woman presented with severe radiating leg pain at the L5 dermatome. She could not stand or walk independently due to severe leg pain. Physical examination revealed weakness of the left great-toe extension and positive straight leg raising test. Magnetic resonance imaging (MRI) showed left paracentral disc extrusion at L4-5 and downward disc fragment migration below the L5 pedicle (Fig. 1). Underlying conditions were diabetes mellitus, hypertension, and rheumatoid arthritis. The patient had been medicating with steroids for a long term and consequently presented with symptoms of iatrogenic Cushing syndrome. A left L5 nerve root block was performed but only provided temporary pain relief. A further therapeutic plan was organized in to 3 steps. First, the patient underwent PELD via the transforaminal route for removal of a paracentral extruded disc and opening of the epidural space between the extruded disc and traversing nerve root. The procedure was performed under local anesthesia in the prone position on a radiolucent table. As per the conventional posterolateral PELD manner (7,8), the endoscopic working cannula (YESS system; Richard Wolf GmbH, Germany) was located between the spinous process and medial pedicle line on anteroposterior radiography with a 25° trajectory angle. The herniated disc was removed using endoscopic forceps. the outer annulus and posterior longitudinal ligament were released by a bipolar radiofrequency coagulator (Elliquence®; Elliquence International Inc., NY) and an endoscopic scissor (Fig. 2A). Second, ELND was performed via the sacral hiatus for removal of the down-migrated disc using a Holmium:yttrium-aluminum-garnet (Ho:YAG) laser. The epidural flexible, fiber optic catheter system (Myelotec®, Myelotec Inc, Rosewell, GA) was introduced through the sacral hiatus (Figs. 2B and 2C). The catheter went up to the L5 pedicle along the ventral surface of the epidural space under fluoroscopic guidance. When the tip of catheter was situated by the L5 inferior pedicle, the disc fragment was differentiated from L5 nerve root under epiduroscopic view (Fig. 2D), and was vaporized by laser (5 J at 5~10 Hz). The catheter was pushed manually into the L4-5 disc space and normal saline was injected into the epidural space of the L4-5 disc level below the L5 nerve root. Lastly, under endoscopic view while performing PELD, the free fragments originating from the down-migrated disc were removed by forceps (Fig. 2E). After surgery, the patient reported complete pain relief. Postoperative MRI showed complete removal of the ruptured disc fragment (Fig. 3).

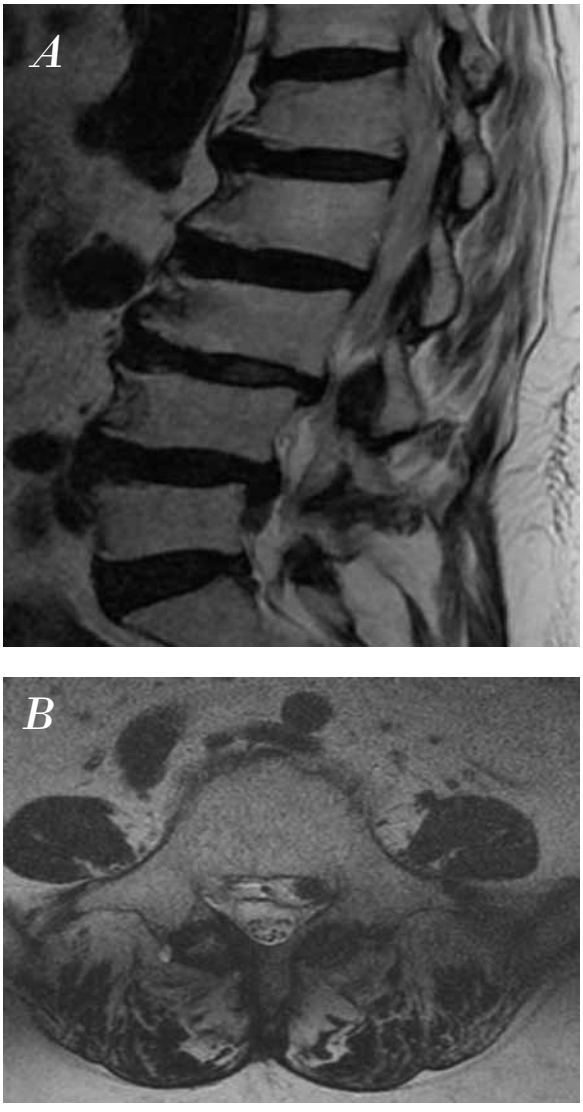

Fig. 1. *T2-weighted sagittal MRI (A) showing disc extrusion at L4-5 and down-migrated disc herniation to the low margin of the L5 pedicle. Axial image (B) showing that the herniated disc is located beneath the L5 nerve root.*

Discussion

The remarkable evolution of PELD has made it an effective treatment for direct removing herniated disc of various types and locations (6,9-11). However, the high grade migrated disc remains an exception (2,3). A down-migrated disc is difficult to access because it is hidden behind the facet joint and pedicle. Also, it is

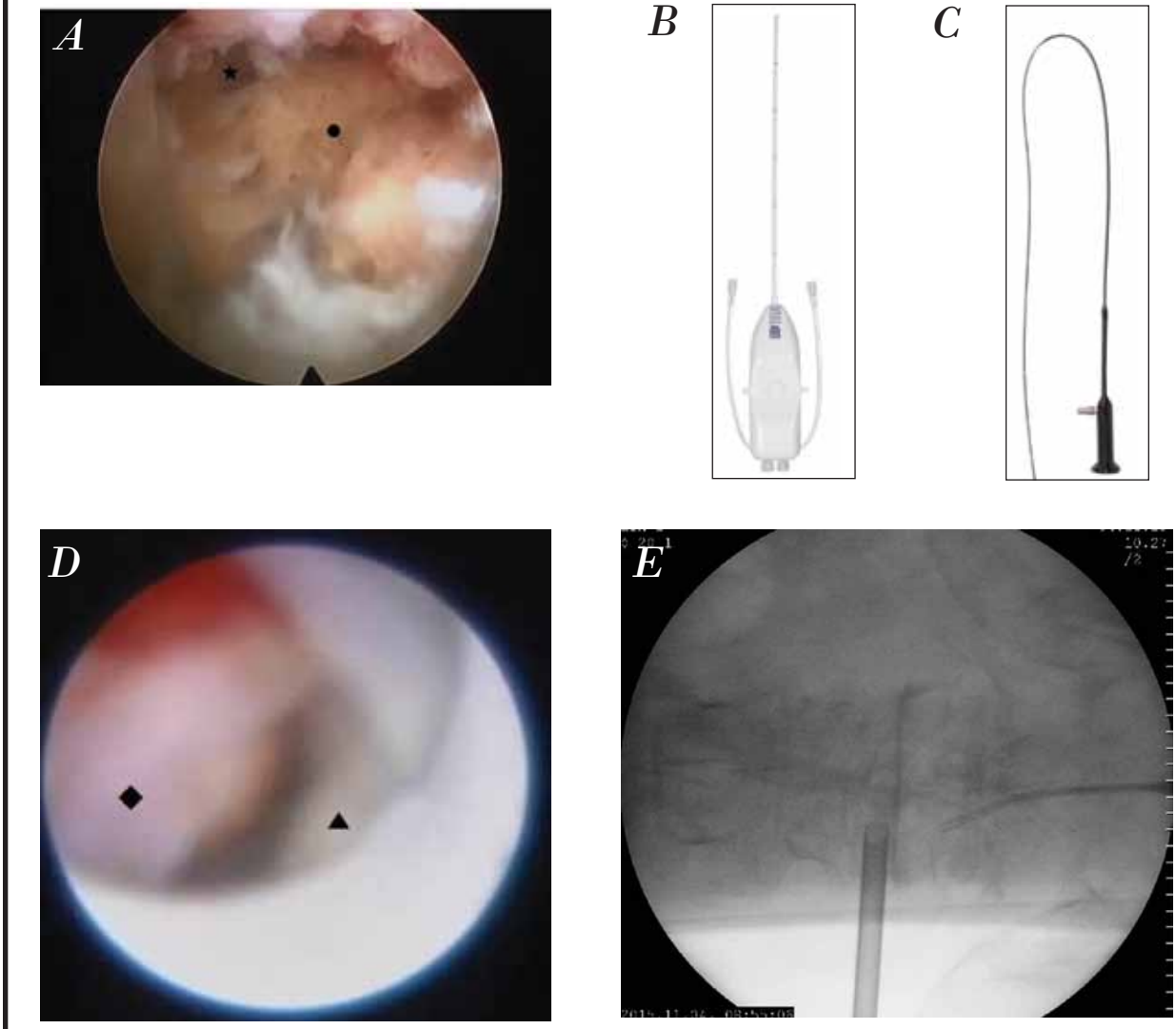

Fig. 2. *A) Endoscopic view of percutaneous endoscopic lumbar discectomy showing a penetration between epidural space (★) and disc space after removal of the subannular disc and cutting of the outer annulus (●). B) A video-guided catheter with 3.0 mm outer diameter has dual working channels. C) Flexible fiber optic scope. D) Epiduroscopic view of epiduroscopic laser neural decompression showing the L5 nerve root (◆) and disc fragment (▲). E) Intraoperative radiography showing the combination of percutaneous endoscopic lumbar discectomy and epiduroscopic laser neural decompression.*

not uncommon to have multiple disc fragments. When the disc fragment extends below half of the pedicle, retained fragments may require revision surgery (2,3,12). Partial removal of the superior facet and pedicle or interlaminar trajectory of the L5-S1 level window may facilitate disc removal (9,10). Occasionally, conventional PELD may sufficiently remove the whole migrated disc by grasping the tip of the disc fragment at the disc space. But, the technique cannot absolutely guarantee complete removal in high grade disc migration.

Epiduroscopic laser neural decompression (ELND) provides a new window to the epidural space as well as a new treatment for herniated disc and epidural fibrosis. Inflamed neural tissue and adhesion tissue around the nerve root can be visualized and directly decompressed by Ho:YAG laser via the sacral hiatus (13,14). The Ho:YAG laser has a wavelength of 2.1 μm and can only penetrate 0.5 mm of tissue. Thermal damage of

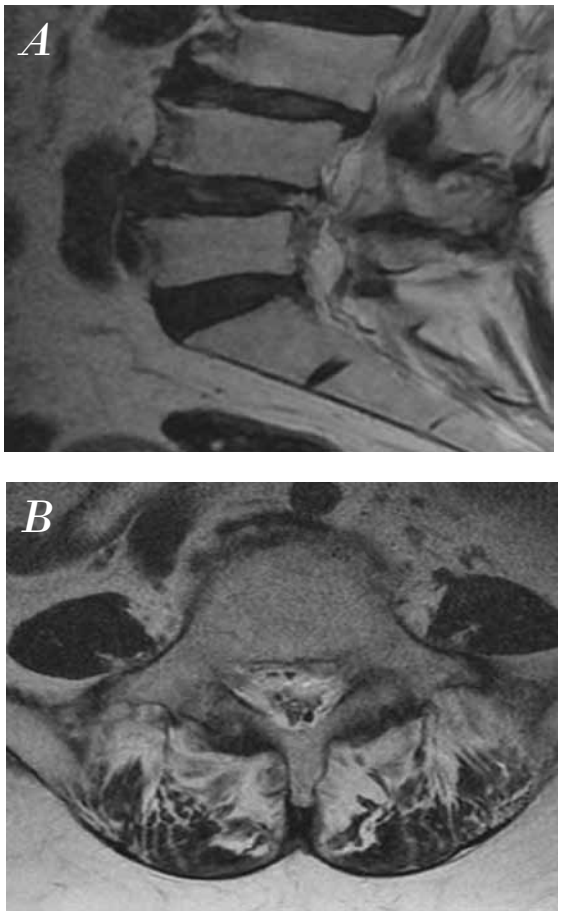

Fig. 3. *After combination of percutaneous endoscopic lumbar discectomy and sacral epiduroscopic laser decompression, postoperative MRI (A and B) showing complete removal of disc herniation.*

the surrounding normal tissue, including the dura and nerve root, is minimized with precise decompression (14).

Although open microdiscectomy is the gold standard for down-migrated disc herniation, this patient could not undergo general surgery due to her age and underlying conditions. PELD is ineffective in grasping down-migrated disc fragments. Likewise, scattered disc fragments left in the epidural space may compress neural tissues after ELND. To overcome such problems, a plan for a combination of PELD and ELND was considered. The reason for the complicated steps of the treatment is compressing the L5 nerve root from the level

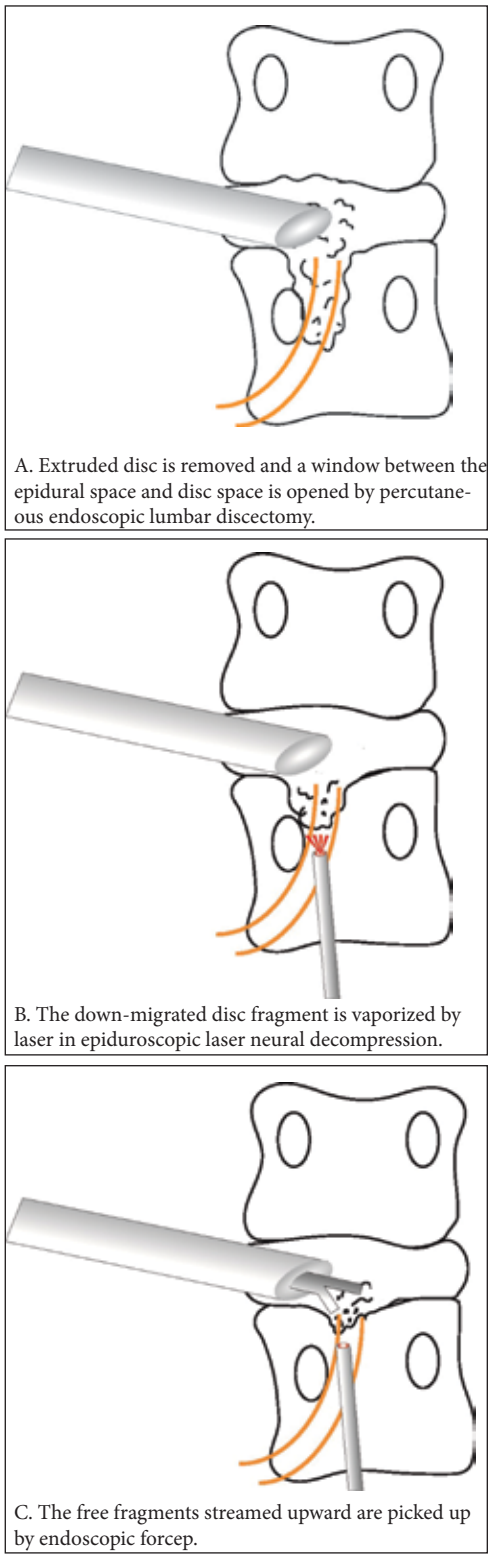

Fig. 4. *Schematic illustration of operative procedures.*

of the L4-5 disc space to the level of the low margin of the L5 pedicle. First, PELD allows simultaneous removal of the extruded disc at the L4-5 disc space by making a window between the disc space and epidural space (Fig. 4A). Second, ELND allows simultaneous vaporization of the down-migrated disc fragment by pushing the free fragment to the L4-5 disc space by straight forward laser and normal saline injection (Fig. 4B). This maneuver is named the "epidural push technique." Lastly, repetitive PELD picks up free fragments streaming upward (Fig. 4C).

It should be noted that this technique can be applied in any degree of down-migrated disc herniation. However, this procedure is limited in resolving severe adhesion between the nerve root and disc fragment or entry difficulty with concurrent lateral recess bony stenosis.

Conclusion

A combination of 2 percutaneous procedures, PELD and ELND, may be a treatment option for down-migrated disc herniation.

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