

Advantages of Endoscope-Assisted Disc-FX in Surgical Management of Lumbar Disc Herniation: A Report of 10 Cases

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Abstract

Objective: Microsurgical discectomy is the gold standard treatment for the herniated nucleus pulposus (HNP) of the lumbar spine. On the other hand, less invasive procedures have been developed and accepted rapidly. Percutaneous endoscopic lumbar discectomy (PELD) was developed as one of the minimally invasive techniques for HNP of the lumbar spine, and satisfactory outcomes have been reported. For the contained type HNP or discogenic pain, however, surgical indication of PELD is sometimes controversial. We describe our experiences of surgical treatment with Disc-FX, focusing on advantages of endoscopic observation.

Patients and Methods: A total of 10 patients with contained type HNP were treated with Disc-FX system. Disc-FX was carried out percutaneously under local anesthesia using a cannula of 3.4 mm diameter, with a trajectory compatible with the transforaminal approach of the PELD. Endoscope was introduced intermittently in 5 patients to observe the results of each procedure.

Results: Sufficient pain relief was achieved in all patients, and Japanese Orthopedic Association score improved from 7-16 (mean 13.0) to 22-29 (mean 25.9), and visual analogue scale improved from 6-10 (mean 8.0) to 0-3 (mean 1.2). Endoscopic observation enabled the procedure almost equivalent to targeted fragmentectomy, and contributed in better surgical outcome.

Conclusion: Disc-FX is a promising procedure in the armamentarium of minimally invasive surgery for the selected conditions of patients, and endoscopic observation is considered to be beneficial in more accurate and adequate decompression.

Keywords: Lumbar disc herniation; Minimally invasive surgery; Disc-FX; Endoscopic observation

Introduction

Microsurgical discectomy is the gold standard treatment for the herniated nucleus pulposus (HNP) of the lumbar spine. Conventional microsurgery is associated with good results, but some damage is caused to the surrounding musculoskeletal structure. To achieve good results with less invasiveness, percutaneous posterolateral nucleotomy was introduced in the early 1970s [1-3]. The initial concept was central disc decompression, but the surgical techniques have evolved during the subsequent 3 decades into targeted fragmentectomy [4]. The term percutaneous endoscopic lumbar discectomy (PELD) is frequently used today to describe various techniques including targeted fragmentectomy. This percutaneous surgical procedure can adopt the transforaminal [5-7], extraforaminal [8], or interlaminar approaches [6,7,9]. Satisfactory success rates (85% to 92%) have been reported, and the advantages of this minimally invasive procedure have been reported [4-13].

Surgical indication for contained type HNP and discogenic pain is controversial [14,15]. There may be no indication of conventional microsurgical discectomy, and application of PELD may also be questionable. But the patients complain of persistent radiculopathy and low back pain despite any kind of conservative therapy, and this condition affects their quality of life. For these conditions, the radiofrequency treatment, Disc-FX (elliquence, New York, USA), is a promising option to provide solutions [16-20]. Disc-FX is carried out percutaneously under local anesthesia using a cannula of 3.4 mm diameter, with a flat horizontal trajectory compatible with the transforaminal approach of the PELD. This technique allows:

- Partial nucleotomy with 2.9 mm grasping forceps.

- Nucleus ablation with Trigger-Flex bipolar turbo mode.
- Annulus modulation with Trigger-Flex bipolar hemo mode.
- Intermittent endoscopic observation is also possible, and similar result as targeted fragmentectomy may be expected with assistance of endoscopic observation.

We report our surgical experiences with Disc-FX, and advantages of intermittent endoscopic observation are discussed with some review of the pertinent literature.

Patients and Methods

Since December 2013, a total of 10 patients were treated by Disc-FX system in the Southern Tohoku Research Institute for Neuroscience. There were 8 male and 2 female patients, with age 30-72 years (mean 47.2 years). Affected levels were L4-L5 in 6 patients, L5-S1 in 2 patients, and 1 patient each at L3-L4 and L1-L2. Operations were carried out under local anesthesia (10 ml of 1% lidocaine), and followed standard procedure (debulking, nucleus ablation, and annulus modulation) under fluoroscopy. Endoscope of 2 mm diameter and straight view was introduced intermittently in 5 patients to observe the results of each

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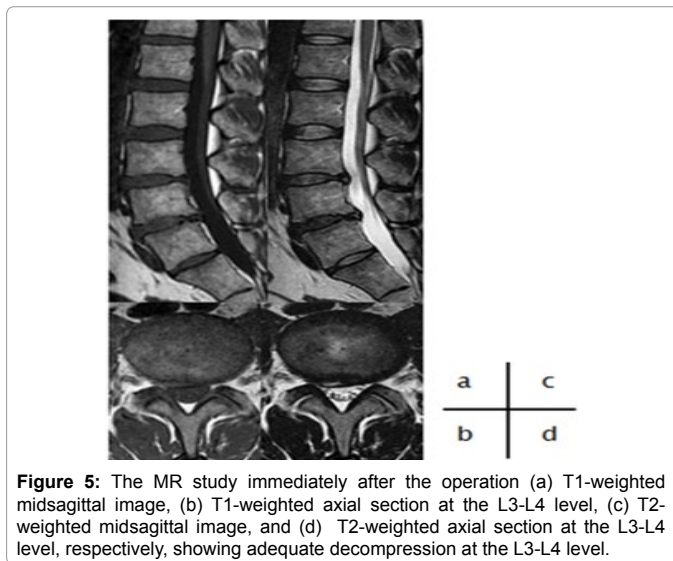
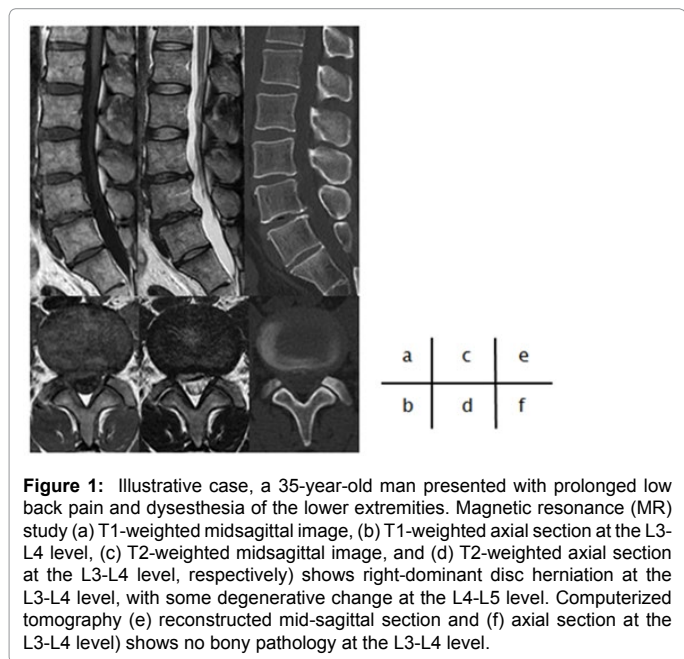
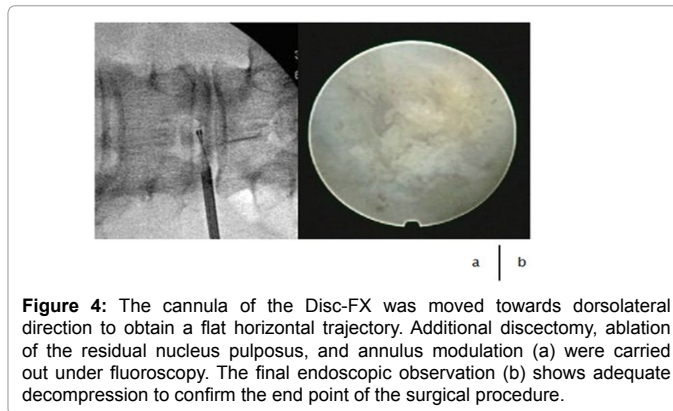
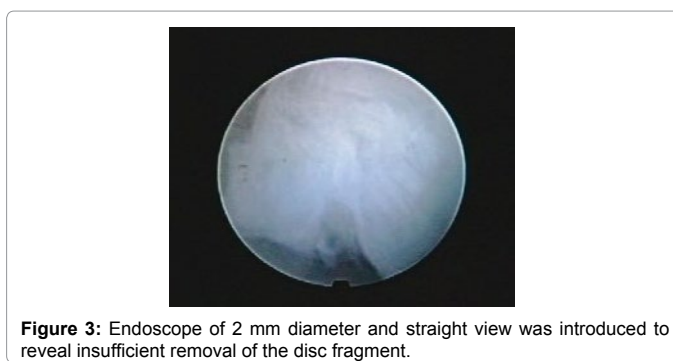
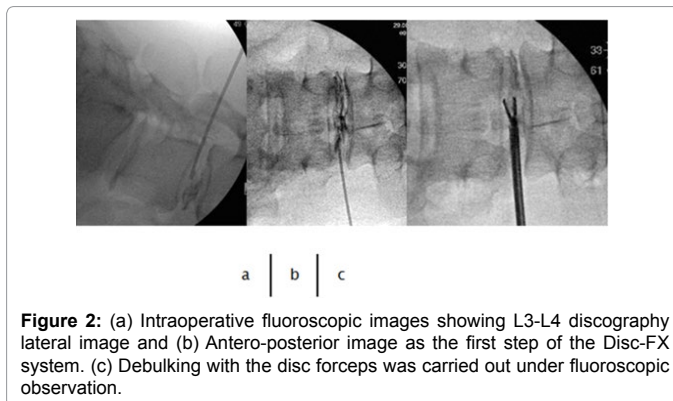
procedure. Surgical outcome was assessed at 6 months postoperatively with the Japanese Orthopedic Association (JOA) score and the visual analogue scale (VAS). All patients underwent magnetic resonance (MR) studies immediately after the operation to evaluate the accuracy of the surgical procedure.

Results

Sufficient pain relief was achieved in all patients, and the JOA score improved from 7-16 (mean 13.0) to 22-29 (mean 25.9), and VAS improved from 6-10 (mean 8.0) to 0-3 (mean 1.2). Endoscopic observation enabled the procedure almost equivalent to targeted fragmentectomy, and contributed in better surgical outcome. The MR study immediately after the operation showed adequate decompression in all the patients. There was no surgical complication, and no patient has required additional microsurgical decompression to date. In 3 patients with follow up period of more than 3 years, favourable surgical outcomes were maintained with minimum symptom of dysesthesia.

Illustrative Case

A 35-year-old man had suffered from low back pain and dysesthesia of the lower extremities for 2 months, which were resistant to any kind of conservative therapy. He visited our outpatient service, and femoral nerve stretching test was positive bilaterally. There was no muscle weakness or pathological reflexes. The magnetic resonance (MR) study (Figure 1) revealed a relatively small disc herniation at the right L3-L4 level and some disc degeneration at the L4-L5 level. The patient asked for surgical treatment due to the prolonged pain, but microsurgical discectomy or PELD were considered too much for this condition. We decided to undertake an operation with the Disc-FX system, and the entry point was decided by measuring under fluoroscopy to obtain a flat horizontal cannula trajectory, which was 12 cm to the right side from the midline in this patient. L3-L4 discography was carried out as the first step of the surgical procedure (Figures 2a and 2b) and followed by partial nucleotomy with 2.9 mm grasping forceps (Figure 2c) as the debulking procedure of the L3-L4 disc space. An endoscope of 2 mm diameter with straight view was introduced to reveal insufficient decompression (Figure 3), and further nucleotomy, nucleus ablation



and after moving the cannula to the dorsolateral direction, annulus modulation (Figure 4a) were carried out under fluoroscopy, assisted by intermittent endoscopic observation. Final endoscopic view (Figure 4b) confirmed satisfactory decompression and ablation. The patient became symptom free on the day of the operation, and resumed his daily activities. The MR study immediately after the operation (Figure 5) showed adequately completed procedure almost equivalent to targeted fragmentectomy at the L3-4 level.

Discussion

The treatment strategies for HNP of the lumbar spine should be primarily conservative and over 90% of the patients show satisfactory response. When the patients do not respond to any kind of conservative therapy, the current gold standard is microsurgical discectomy, and attempts to minimize surgical invasiveness, such as procedures with tubular retractors, have been proposed. However these less invasive procedures are associated with tendency of earlier surgical intervention and significant increase of costs as a result. Peul and co-authors evaluated the cost efficacy of early surgery to be an extremely expensive method from a healthcare economic perspective [21]. The complication rate as high as 8% and trauma caused by an approach are important factors in assessment of the value of surgical treatment [18]. To achieve good results with less invasiveness, percutaneous postero-lateral nucleotomy was introduced in the early 1970s [1-3]. Evolution of the spinal endoscope allowed direct visualization via a uniportal approach, and further modification allowed multichannel irrigation, specialized cannulas and discectomy tools [22,23]. Full-endoscopic surgery for HNP of the lumbar spine has been associated with equivalent surgical outcome as the conventional procedure and minimized surgical invasiveness [4-13], and it attracts spine surgeons today.

The Disc-FX system was developed in the hope of addressing the unsatisfactory clinical outcomes for contained type HNP, combining the knowledge gained from uniportal percutaneous approach such as nucleoplasty and the proven positive effects of high radiofrequency [18]. Through a stab wound of 4 mm and cannula of 3.4 mm diameter, this surgical procedure under local anesthesia allows:

- Debulking of the disc space with 2.9 mm grasping forceps.
- Nucleus ablation with Trigger-Flex bipolar turbo mode.
- Annulus modulation with Trigger-Flex bipolar hemo mode.

The use of higher radiofrequency of 1.7 MHz through the elliquence Surgi-Max generator offers the advantage of reduced heat and minimal tissue ablation [16,17].

As shown in the full-endoscopic surgery, combination of different steps improves the outcome, and additional step of intermittent endoscopic observation is expected to improve accuracy of the procedure [17]. Since targeted fragmentectomy is the goal of the current surgical treatment for lumbar disc herniation, use of endoscope is considered to be beneficial in achieving better surgical outcome. Additionally, the surgical procedure under local anaesthesia offers the patients diminished peri- and postoperative stress, and a faster recovery, mobilization, less postoperative pain and reduced medical costs are expected [18,24]. Furthermore, this procedure is expected to provide long-lasting pain relief, up to 2 years or more after the operation [20].

Conclusion

In conclusion, Disc-FX is a promising procedure of minimally invasive surgery for the selected conditions of patients, and endoscopic observation is considered to be beneficial to achieve more accurate

and adequate decompression. This technique is significantly beneficial in providing the patients an option of avoiding an open surgery and leaving the dorsal approach virgin [18]. Current ideal indication criteria for Disc-FX would be

- Patients with small, contained type HNP.
- Patients with back pain due to annular tear.
- Patients with difficulty in accurate diagnosis due to the discrepancy between the neurological evaluation and radiological findings.

This article describes our preliminary results with a prototype endoscope, and the image quality may not be good enough to convince the advantages of endoscopic observations. With development of endoscope with higher visual quality, further improvement will be expected as the evidence on the efficacy of the Disc-FX are collected by larger studies and longer follow up.

Conflict of Interest

The authors report no conflict of interest concerning the materials or methods used in this study or the finding specified in this paper.

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