Biportal Percutaneous Endoscopic Discectomy for Recurrent Lumbar Disc Herniation: Preliminary Report

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Background: *Repeated open discectomy has been the most common surgical procedure for recurrent lumbar disc herniation. There were no published reports on the BPED for recurrent disc herniation.*
Objective: *To evaluate the efficacy and surgical outcome of BPED for recurrent lumbar disc herniation.*
Material and Method: *A study of 27 consecutive patients who underwent biportal percutaneous endoscopic discectomy (BPED) for recurrent lumbar disc herniation. The inclusion criteria were recurrent disc herniation at the same level, regardless of side, with a pain-free interval longer than 6 months after the conventional discectomy. BPED were performed under general anesthesia.*
Results: *The mean follow-up period was 26 months (24 to 32 months). Based on the modified MacNab criteria, 81.4% showed excellent or good outcomes. The mean visual analog scale decreased from 8.2±1.2 to 2.3±2.0 ($p<0.05$).*
Conclusion: *BPED was an effective surgical procedure for recurrent lumbar disc herniation. The endoscopic approach through scarred tissue did not increase nerve injury and show complications.*

Keywords: *Endoscope, Biportal, Two portal, Discectomy, Percutaneous, Revision, Recurrent herniated nucleus pulposus*

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Lumbar disc herniation is one of the most common causes of back pain and radiculopathy. Surgery is an effective option when the disease is refractory to conservative treatments[1]. Despite advances in the techniques for lumbar discectomy, there is a certain set of patients who develop recurrent disc herniation. This condition defined as re-herniation on the same side and at the same level where a previous discectomy has been performed[2,3]. Patients who develop recurrent symptoms after lumbar discectomy present a significant challenge for the surgeon. Management of the patient with recurrent disc herniation may involve many of the same approaches as are used for management of primary disc herniation, including conservative treatment such as observation, pharmacologic therapy, physical therapy and surgery[4,5]. However, there are additional considerations, as repeated discectomy involves increased risk of complications, such as nerve root injury, accidental dural tear and decreased chances of a successful clinical outcome[6-11]. The standard surgical approach for the treatment of recurrent disc herniation usually utilizes a classic technique with a wide exposure[10,11]. Loss of bony landmarks and scar tissue adherence to the dura and nerve roots create a distorted surgical anatomy, and this wider exposure is thought to aid in reducing complications. However, approach-associated complications attributed to more tissue scarring and adjacent segment degeneration caused by further damage to the vertebral motion segments should be considered[12-14]. Furthermore, other than repeated open lumbar surgery, percutaneous endoscopic lumbar discectomy (PELD) is another operative option to be considered. PELD can avoid repeated damage to the posterior and paraspinal structures. PELD had already shown encouraging results for lumbar herniated disc[15-23]. Complex surgical techniques and special instruments usage are the major disadvantages of single portal PELD. In order to reduce surgical difficulties during single portal percutaneous endoscopic discectomy, this article used biportal percutaneous endoscopic approach[23]. This technique had many advantages. First, this procedure used only ordinary arthroscopic and spine instruments without any special endoscopic devices. Second, the surgical tool and the endoscope were freely moved of each

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other so they were not crowded in the confines of a common working portal. Lastly, continuous saline irrigation facilitates cleaning the endoscopic field and the lens from blood. The purpose of this study was to report on the safety and effectiveness of biportal percutaneous endoscopic disecetomy (BPED) in the patients with recurrent lumbar disc herniation.

Material and Method

The study was approved by the local ethics committee (SWUEC/EX 32/2554). A consecutive series of patients who underwent BPED for recurrence lumbar disc herniation between January 2012 and December 2014 were followed. All patients underwent pre-operative x-ray and magnetic resonance imaging (MRI) examinations before revision operation.

The inclusion criteria were as follow.

1) The patient who had clinical and radiographic findings consistent with recurrent disc herniation at the same level of previous surgery with a pain-free interval longer than 6 months after the conventional open discectomy.

2) The patients failed conservative treatment at least 6 months prior. The conservative measures included activity restriction, non-steroidal anti-inflammatory medications and physical therapy.

The exclusion criteria were:

1) The subject who had coronal plane deformity with Cobb angle more than 10 degrees.

2) The dynamic flexion-extension radiograph shows translation more than 5 degree or translation more than 10 mm.

Surgical technique

The procedure was performed using general anesthesia with the patient positioned prone. The patient's arms were lifted upward with care to avoid extension beyond 90 degrees. Once the appropriate spinal level had been confirmed using C-arm fluoroscopy, two stab incisions were made 1.5 to 2 cm from midline toward the planned side and level of operation. Endoscope and working portal were inserted through the incisions (Fig. 1). Localization was reconfirmed with lateral view of fluoroscopy. Under direct visualization using radiofrequency cautery, scar tissue was carefully removed to expose the medial aspect of the remaining facet joint and laminar. The medial facet lateral to the previous laminectomy was thinned a few millimeters using a high speed burr. Kerrison rongeur was then used to expose a virginal tissue plane. The lateral edge of the dura and the nerve root were identified. The scar tissue and remnant of ligamentum flavum were carefully dissected from dural sac and nerve root. Then, we gently moved the nerve root medially and used discectomy rongeur to remove the nucleus pulposus. The adequacy of decompression was determined by observing the nerve roots motion to confirm the extent of decompression. Skin was closed without suction drain after complete procedure. A typical patient was presented in Fig. 2, which illustrated a 51-year-old woman who presented with low back pain radiating to the left leg four years after L4–L5 discectomy. She had two years mostly pain-free intervals with only episodic low back pain after her previous discectomy. During the year before presentation, she experienced increasing back pain

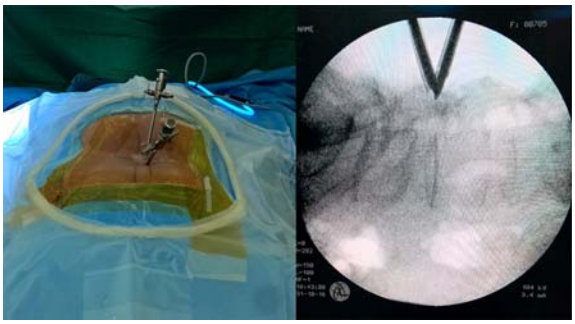

Fig. 1 Endoscope portal and working portal were inserted through the two separated skin incision and docked onto the facet joint.

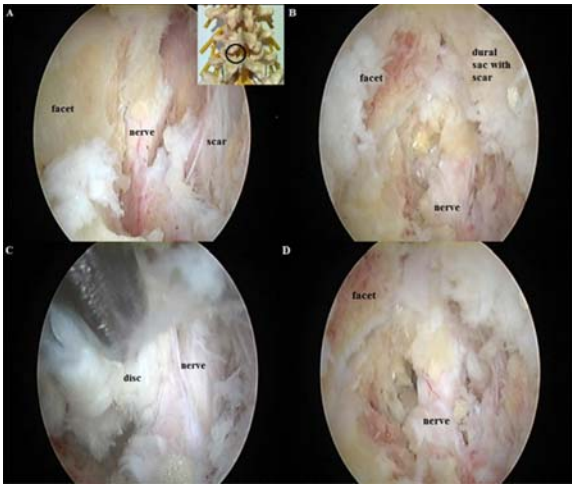

Fig. 2 A) Partial medial facetectomy, nerve root and scaring of dural sac were seen, B) Ligamentum flavum of the ipsilateral site was removed, C) The nucleus pulposus was excised, D) The procedure was complete.

radiating to the left leg in the distribution of L5 nerve root.

Postoperative treatment and follow-up visits

The patients were ambulation with elastic waist braces in the day of surgery and back muscle training after 3 to 4 days. The patients resumed their daily activities with a waist girdle 3 weeks later. Outpatient follow-up visits were conducted in the 3rd, 6th, 12th month after surgery and every year thereafter. The primary outcomes included a visual analog scale (0 to 10), modified MacNab criteria and Oswestry disability index (ODI) (0% represents no pain and no disability and 100% represents the worst possible pain and disability). The secondary outcomes included the operative time, re-operation and complication rates. All data were analyzes with paired t-test with the SPSS version 11.0 software package. Differences were considered significant if $p<0.05$.

Results

There were twelve males and fifteen females included in the study (Table 1). The ages of the patients ranged from 26 to 73 years old (mean 46 years old). The mean follow-up period was 26 months (range 24 to 32 months). The mean operative time was 105 minutes (range 78 to 163 minutes). The mean length of hospital stay was 1.4 days (range 1 to 3 days). Twenty-six of twenty-seven patients returned fully completed questionnaires pre-operatively, at 3 months, six months, and at a year after the operation and at the final follow-up. The mean VAS score for leg pain decreased significantly from 8.2±1.2 (range 6 to 10) pre-operatively to 2.3±2.0 (range 0 to 5) at 3 months and 1.2±1.5 (range 0 to 4) at the final follow-up ($p<0.05$). The mean VAS score for back pain decreased from 3.3±1.5 (range 1 to 4) preoperatively to 2.9±1.8 (range 0 to 4) at 3 months and 3.1±1.6 (range 0 to 4) at the final follow-up (NS). The mean ODI improved significantly from 56.9±28.2 (range 28 to 82) pre-operatively to 30.8±22.4 (range 10 to 62) at 3 months and 20.4±15.9 (range 2 to 41) at the final follow-up ($p<0.05$). Approximately 80% of patients in this study had good or excellent outcomes based on modified MacNab criteria. The remaining 3 patients had fair outcomes, and no patient had a poor outcome. There were two patients with second degree burn around the surgical site. The treatment was sterile dressing and oral antibiotic. All of the patients healed without complication (Fig. 3). One incidental durotomy occurred during the operation. The tear site was so small that it could be packed with gel foam. Post-operative ambulation was postpone and with no clinical post-operative celebrospinal fluid leakage. One patient (3.7%) had transient paresthesia postoperatively, which resolved completely within 3 months. One patient (3.7%) required revision surgery within 36 months after procedure because of postoperative spinal instability. There were no major complications such as permanent neurological deficit, pulmonary embolism, perioperative cardiac events or death.

Discussion

BPED was a form of minimally invasive surgery. This technique had many advantages over single portal

Table 1. Summary of demographic and clinical characteristics for patients undergoing biportal percutaneous endoscopic discectomy for recurrent lumbar disc herniation

Variable	Observed value
Mean patient age at the time of repeatsurgery, year (SD, range)	46 (14, 26-73)
Male patients (%)	12 (44)
Female patients (%)	15 (56)
Level of herniation	
L4-5 (%)	22 (85)
L5-S1 (%)	6 (15)
Side of herniation	
Left (%)	13 (48)
Right (%)	14 (52)
Approach for initial surgery	
Open (%)	25 (92)
Microendoscopicdisectomy (%)	2 (8)
Mean time between initial surgery andsurgery for recurrent herniation, months (SD, range)	31.2 (38.9, 3.4-129.9)
Mean length of follow-up after surgeryfor recurrent herniation, months (SD, range)	26 (10, 24-32)

Table 2. Summary of surgical parameters for patients undergoing biportal percutaneous endoscopic discectomy for recurrent lumbar disc herniation

Variable	Observed value
Mean operative time, minute (SD, range)	105 (46, 78-163)
Mean hospital stay, day (SD, range)	1.4 (0.4, 1-3)
Complication, number (%)	
Incidental durotomy	1 (3.7)
Recurrent disc	0
Surgical wound infection	0
Second degree burn around surgical site	2 (7.4)
Neurologic injuries	
Transient paresthesia	1 (3.7)
Complete neurological deficit	0

Fig. 3 The second degree burn was healed three months after revision discectomy.

PELD. There were some studies which discussed the use of single portal PELD for patients with recurrence of disc herniation. The study performed by Hoogland[15,16] evaluated a series of patients who received transforaminal PELD for recurrence of disc herniation showed that both leg pain and back pain improved significantly. The results of their surgeries were rated as excellent or good in 85.7% of the patients at 2-year follow-up. In this study, BPED was the safe and effective surgical approach for treatment of recurrent lumbar disc herniation after conventional open techniques. This procedure provided an effective working portal to expose and extend the edges of the prior laminectomy defect to reveal the virginal tissue plane that allowed safe exploration and discectomy. The surgical technique was superior to single portal PELD in many aspects as we described in the introduction section. Although the design of this study did not compare it with a control group, the clinical outcomes were equal with other revision percutaneous endoscopic reports. Our mean operative time of 105 minutes was comparable with that of prior reports in which mean operative time was 99 minutes for single portal PELD[2,3]. Our mean length of hospital stay of 1.4 days also compared favorably with prior reports in which the mean stay for recurrent discectomy range from 7 hours to 13 days[16,23]. In this study, the most common complication was second degree burn around surgical site (Fig. 3). The fluid leakage around the portal incision might be the cause of this complication because the leaked fluid while using radiofrequency cautery had a high temperature. Another complication that occurs after the surgery was incidental durotomy. This complication in the present series was seen in one case. The problem typically encountered during dissection of scar tissue. This rate of durotomy was comparable with that in previous reports of recurrent discectomy in which the rate ranged from 5% to 18%[16,23]. Accidental dural tear in this study was not large enough to warrant direct repair and was treated by gel foam occlusion. The patient healed without complication. There were several limitations of this study. First, the surgeon should have adequate experience operating with an endoscope before attempting excision of the surgical

procedure. It was important for the surgeon to be comfortable operating using a two dimensional endoscope. Failure to acquire this experience before attempting the procedure might increase the risk of significant complications. Second, this study did not show postoperative instability. Some part of the facet joint was removed during the procedure so longer follow-up period with dynamic radiographs are required for late instability detection.

Conclusion

Surgical decompression with BPED had initial benefits and the same result as single portal PELD, but long-term studies should pay more attention to the risks of postoperative instability and restenosis as well as the need for re-operation. Larger prospective comparative study with a long-term, follow-up would be helpful to validate this technique across the recurrent lumbar disc herniation.

What is already known on this topic?

Single portal PELD had the same result as conventional revision discectomy.

What this study adds?

BPED had the same clinical result when compared with single portal PELD.

Potential conflicts of interest

None.

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การศึกษาการรักษาโรคหมอนรองกระดูกทับเส้นประสาทที่กลับเป็นซ้ำภายหลังการผ่าตัดด้วยวิธีผ่าตัดส่องกล้องชนิดสองทางเข้า: รายงานการศึกษาเบื้องต้น

ยิ่งยง ต่ออุดม, จรูญ จันทร์ดำรงกุล

วัตถุประสงค์: *ศึกษาผลการรักษาโรคหมอนรองกระดูกทับเส้นประสาทที่กลับเป็นซ้ำภายหลังการผ่าตัดด้วยวิธีผ่าตัดส่องกล้องชนิดสองทางเข้า*

วัสดุและวิธีการ: *ศึกษาติดตามผลผู้ป่วยจำนวน 27 ราย รายงานวิธีการผ่าตัด ข้อมูลทั่วไปของผู้ป่วย จำนวนวันที่ผู้ป่วย พักรักษาเป็นผู้ป่วยใน ความปวดก่อนและหลังการผ่าตัด รวมถึงภาวะแทรกซ้อนภายหลังการผ่าตัด*

ผลการศึกษา: *สามารถติดตามผู้ป่วยได้ 26 ราย จำนวนวันเฉลี่ยที่เป็นผู้ป่วยในเท่ากับ 1.4 วัน อาการปวดขาที่วัดด้วยเครื่องมือวัดความปวด VAS ลดลงจาก 8.2±1.2 เป็น 2.3±2.0 ($p<0.05$) ประมาณ 81.4% ของผู้ป่วยอาการดีขึ้นเมื่อวัดด้วยตัวชี้วัด modified MacNab criteria ภาวะแทรกซ้อนที่พบบ่อยที่สุดคือ การไหม้ของผิวหนังรอบบริเวณที่ผ่าตัด ส่วนภาวะแทรกซ้อนอื่นเมื่อเปรียบเทียบแล้วจะเท่ากับวิธีผ่าตัดส่องกล้องชนิดทางเข้าเดียว*

สรุป: *การผ่าตัดส่องกล้องชนิดสองทางเข้าให้ผลดีเทียบเท่ากับวิธีผ่าตัดส่องกล้องชนิดทางเข้าเดียว การศึกษาเปรียบเทียบที่มีจำนวนประชากรที่มากขึ้นในอนาคตจะทำให้ผลการรักษาน่าเชื่อถือมากยิ่งขึ้น*