Comparison of Three Minimally Invasive Spine Surgery Methods for Revision Surgery for Recurrent Herniation After Percutaneous Endoscopic Lumbar Discectomy

Yuan Yao[1], Huiyu Zhang[2], Junlong Wu[1], Huan Liu[1], Zhengfeng Zhang[1], Yu Tang[1], Yue Zhou[1]

■ BACKGROUND: **Patients who experience a recurrence of percutaneous endoscopic lumbar discectomy (PELD) need to undergo revision surgery when they fail to respond to conservative therapy. Minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF), microendoscopic discectomy (MED), and PELD are 3 common minimally invasive surgical approaches for PELD recurrence. However, there have been no studies that have focused on the selection of the minimally invasive surgical method for PELD recurrence.**

■ METHODS: **Seventy-four patients who underwent revision surgery (MIS-TLIF, 26 cases; MED, 20 cases; PELD, 28 cases) for PELD recurrence were enrolled in this study. The preoperative characteristics and perioperative data were collected. Additionally, the clinical outcomes (visual analogue scale, Oswestry Disability Index, and the 12-item Short Form Health Survey) were collected and assessed at 1, 3, 6, 9, and 12 months postoperatively.**

■ RESULTS: **No significant differences in clinical outcomes over time were observed between these 3 surgical approaches. MED and PELD were associated with greater pain-relief effects at 1 month after surgery than MIS-TLIF, but this effect equalized at 3 months postoperatively. MED and PELD exhibited the advantages of reductions in operation time, blood loss, hospital stay and total cost compared to MIS-TLIF. However, MED and PELD also were significantly associated with greater recurrence rates than MIS-TLIF.**

■ CONCLUSIONS: **None of the three surgical approaches exhibited clear advantages in long-term pain or functional scores. MED and PELD were associated with lower costs and better perioperative effects than MIS-TLIF. However, compared with MIS-TLIF, the higher recurrence rates of MED and PELD should not be ignored.**

INTRODUCTION

Percutaneous endoscopic lumbar discectomy (PELD) has become a feasible alternative to the conventional open surgery for the treatment of lumbar disc herniation.[1] Despite of the merit of minimal invasiveness, the occurrence of recurrent herniation has aroused the concerns of many medical researchers.[2,3] The majority of patients suffering from a recurrence of PELD have to undergo revision surgery if the conservative treatment fails to relieve the pain symptoms. Until now, however, no studies have been performed to provide a reference for the selection of the revision surgery for PELD recurrence. It is well known that minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF), microendoscopic discectomy (MED), and PELD are 3 common choices for revision surgery for recurrent herniation.[4-6] In this study, we compared the outcomes of these 3 minimally invasive spine surgery methods that are used to treat the recurrence of PELD and attempted to explore some helpful insights into the preoperative selection of the revision surgery for the recurrence of PELD.

Key words
- Percutaneous endoscopic lumbar discectomy
- Recurrent herniation
- Revision surgery

Abbreviations and Acronyms
MCS: Mental component summary
MED: Microendoscopic discectomy
MIS-TLIF: Minimally invasive transforaminal lumbar interbody fusion
ODI: Oswestry Disability Index
PCS: Physical component summary
PELD: Percutaneous endoscopic lumbar discectomy
RMB: Yuan Renminbi
SF-12: 12-item Short Form Health Survey
VAS: visual analogue scale

From the [1]Department of Orthopedics, Xinqiao Hospital, Third Military Medical University, Chongqing; and [2]Department of Stomatology, the 457th Hospital of PLA, Wuhan, China

To whom correspondence should be addressed: Yue Zhou, Ph.D., M.D.; Yu Tang, M.D. [E-mail: happyzhou@vip.163.com; tangyu628@sina.com]

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Table 1. Preoperative Demographic and Clinical Characteristics

Characteristics	MIS-TLIF	MED	PELD	*P* Value
Number of patients	26	20	28	
Sex: male/female	13/13	11/9	18/10	0.561
Age, years	51.62 ± 10.04	51.05 ± 16.38	53.68 ± 17.70	0.809
Marriage: yes/no	26/0	19/1	27/1	0.548
BMI	25.51 ± 4.30	26.42 ± 4.04	25.33 ± 3.96	0.642
Alcohol use: yes/no	4/22	2/18	3/25	0.821
Smoking: yes/no	5/21	2/18	5/23	0.671
Hypertension: yes/no	5/21	3/17	4/24	0.873
Herniation level: L5-S1/L4-L5	8/18	7/13	9/19	0.954
Migrated/nonmigrated herniation	15/11	11/9	18/10	0.791
Modic change: yes/no	7/19	9/11	13/15	0.281
Paramedian/central herniation	16/10	12/8	19/9	0.828
VAS (back pain)	5.96 ± 1.15	6.20 ± 1.24	5.86 ± 1.11	0.598
VAS (leg pain)	6.96 ± 1.28	7.35 ± 0.99	7.22 ± 1.00	0.482
ODI	28.0 ± 4.02	29.10 ± 5.17	27.65 ± 4.66	0.576
SF-12 PCS	30.77 ± 6.11	27.25 ± 6.78	29.79 ± 6.82	0.194
SF-12 MCS	24.23 ± 5.08	22.89 ± 5.70	22.05 ± 5.04	0.308

MIS-TLIF, minimally invasive transforaminal lumbar interbody fusion; MED, microendoscopic discectomy; PELD, percutaneous endoscopic lumbar discectomy; BMI, body mass index; VAS, visual analogue scale; ODI, Oswestry Disability Index; SF-12, 12-item Short Form Health Survey; PCS, physical component score; MCS, mental component score.

MATERIALS AND METHODS

Patients

A series of 3158 patients were treated by PELD for lumbar disc herniation in our hospital from March 2005 to October 2015. Seventy-four patients who suffered from PELD recurrence and underwent reoperation (MIS-TLIF, 26 cases; MED, 20 cases; PELD, 28 cases) were included in this study. All the study procedures were approved by the Ethics Committee of Xinqiao Hospital, Third Military Medical University and were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

The indications for surgery were as follows. 1) The patient met the criteria for PELD recurrence (i.e., the patient had undergone a successful PELD as confirmed by a pain-free period of at least 1 month, there were recurrent symptoms of pain, and an magnetic resonance imaging scan confirmation of a reherniated fragment on the same level as the previous PELD surgery was achieved). 2) Conservative therapy failed to relieve the recurrent pain.

The selection of MIS-TLIF is recommended in the cases of vertebral instability or spondylolisthesis. With the exception of the aforementioned conditions, for pure herniation, no definite inclusion or exclusion criteria for these 3 surgical methods (i.e., MIS-TLIF, MED, and PELD) have been reported. Thus, in principle, these 3 surgical methods are considered suitable for all patients without vertebral instability or spondylolisthesis. Actually, in this study, there were no patients who exhibited vertebral instability or spondylolisthesis. Therefore, we believe each of included patients was appropriate for each of these 3 surgical methods. Full disclosure of all the surgical details, including the surgical procedures, total cost, experience of the surgeons, complications, and possible therapeutic effects, was provided to the patients, and the final selections were made by the patients.

Clinical Assessment

The preoperative data from all the enrolled patients were assessed in terms of demographic data (i.e., sex, age, marital status, body mass index, alcohol use history, smoking history, and hypertension history) and clinical data (i.e., herniation level, migrated/nonmigrated herniation, Modic change, and paramedian/central herniation).

Every enrolled participant was asked to complete a questionnaire that included visual analogue scales (VAS) for both low back pain and leg pain, the Oswestry Disability Index (ODI), and the 12-item Short-Form Health Survey (SF-12, which consists of a physical component summary [PCS] and a mental component summary [MCS]) preoperatively and at each time point of the follow-up visits. The follow-up visits were performed at the time points of 1, 3, 6, 9, and 12 months postoperatively. The patients received and returned the questionnaire via e-mail or mail and were contacted by telephone if necessary. In addition, the perioperative conditions (i.e., operation time, blood loss, and hospital stay), cost, complications, and recurrence condition also were collected and evaluated.