



Original research

Comparison of tissue damages caused by endoscopic lumbar discectomy and traditional lumbar discectomy: A randomised controlled trial



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ABSTRACT

Objectives: This study aimed to compare the clinical efficacies of percutaneous endoscopic lumbar discectomy (PELD) and traditional open lumbar discectomy (OD).

Methods: The pre-operative and post-operative blood loss, hospital stays and wound sizes of the patients in the two groups were recorded. Enzyme-Linked immunosorbent assay was used to measure the changes of interleukin-6 (IL-6), C-reactive protein (CRP) and creatine phosphokinase (CPK) pre-operation and 1 h, 6 h, 12 h, 24 h and 48 h after corresponding surgery. Visual Analog Scale and Modified MacNab Criteria were used to assess post-operative results.

Results: Patients in the PELD group had less blood loss ($p < 0.01$), shorter hospitalization hours ($p < 0.01$) and smaller surgical wounds ($p < 0.01$) than the patients underwent traditional OD surgery. MacNab evaluated that the levels of satisfaction were above 90% in both groups post-operative six months. There was no significant difference in pain index between the two groups ($p > 0.05$). Furthermore, the levels of CRP, CPK and IL-6 in the PELD group were all lower than those in the OD group with a significant difference ($p < 0.01$).

Conclusion: The PELD had less damage to human tissues than the traditional OD. PELD has a clear promotional value in clinical.

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1. Introduction

The spinal musculoskeletal system is destroyed in the traditional open lumbar discectomy (OD), which could easily induce neural adhesion, spinal structural damages, instability and other complications [1]. Therefore, the caused trauma could lead to a series of reactions *in vivo*, including ascent of stress hormones, production of pro-inflammatory cytokines, as well as abnormal metabolic phenomenon [2–5]. And the systemic cytokines caused by tissue damages could produce a series of adverse reactions and affect the important organs in human immune system. The minimally invasive surgery aims to achieve the least amount of trauma to human body by changes of special instruments, such as endoscopes and laser, and progresses of surgical technologies. Thus the damage of human organs and immune response caused by

systemic cytokines due to the tissue damage from this surgery would be reduced [6–11].

Therefore, the levels of systemic cytokines could be used to assess the postoperative tissue damages. Percutaneous endoscopic lumbar discectomy (PELD) is a new type of spinal minimally invasive surgery in recent years, which does not need general anesthesia and has a different surgery way and method from the traditional surgery [12,13]. PELD, a safe procedure for soft disc herniation, causes few damage to muscular and ligamentous [14]. Furthermore, some researchers have applied PELD to treat single level soft lumbar disc herniation and have received favorable consequences [15]. Nevertheless, there are few objective experimental data to confirm that PELD could cause less tissue damages than OD.

This study aimed to compare the clinical results, including pre-operative and post-operative blood loss, hospital stay, wound size, Visual Analog Scale (VAS), post-operative satisfaction and times of work recovery of PELD and traditional OD. In addition, the pre-operative and post-operative changes of systemic cytokines were analyzed to confirm that PELD had the potential to cause fewer

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damages to human tissues than the traditional OD, with quicker recovery time and shorter hospital stay in patients. In a word, PELD has a very clear promotional value in clinical research and is more effective than OD.

2. Subjects and methods

2.1. General data

A two-group randomized controlled prospective study was undertaken between October 2010 and April 2011. The indication for this surgery was herniated disk compressing the spinal nerves. The patients which were invalid after three months of conservative treatment were excluded. The exclusion criteria were set as below: (1) Patients with cauda equina syndrome; (2) Patients who had mental disease; (3) Patients who showed spinal instability; (4) Patients with serious motor nerve damages; (5) Patients who had systemic diseases, such as diabetes and hepatic diseases; (6) Patients with infectious diseases; (7) Patients who had recurrent disc herniation. After the inclusion criteria were met and informed consent was obtained, patients were allocated randomly into one of two groups: OD group and PELD group, with 10 patients in each group.

2.2. Percutaneous endoscopic lumbar discectomy

The patients underwent local anesthesia in the operative prone position on the see-through operating table just before the surgical procedure. Fentanyl (2–5 µg/kg) was added to alleviate the pain and maintain the sober situation in patients according to the doctor. The joimax lumbar endoscopic system was used with an external diameter of 7 mm and a pipeline of 3.1 mm. Along the import pathways, the spinal coordinate direction was confirmed with 10–14 cm away from the middle line mostly from the rear lateral position. The guide needle was inserted at an angle of 10–25° to the horizontal plane, followed by insertion of the pipeline into the periphery of intervertebral foramen and a 5–7 mm stab wound on the skin was made. The spinal endoscope was put into the relevant position. The rear pathway was applied in the L5-S1 and some free herniated discs. All processes were under the C-arm fluoroscopy. The catheter was put in the lesion position. Ellman bipolar radiofrequency was used for hemostasis and vaporizing tissues and Ho-Yag laser was used for assisted resection of some proliferated bone and herniated disc. At the same time, the intervertebral disc clips with different sizes were used to clip out of the loose herniated nucleus pulposus. The whole surgery was about 30–60 min.

2.3. Traditional surgery

The intervertebral discs were excised from spinal laminectomy under general anesthesia and the traditional surgery was performed according to the previous approach [16].

2.4. Index detection and surgical assessment

VAS and Modified MacNab Criteria were used to evaluate the post-operative results. The pre-operative and post-operative blood loss, hospital stays and wound size of patients in the two groups were recorded. Enzyme-Linked immunosorbent assay (ELISA) was used to measure pre-operative and post-operative changes of interleukin-6 (IL-6), C-reactive protein (CRP) and creatine phosphokinase (CPK) at 1 h, 6 h, 12 h, 24 h and 48 h.

2.5. Statistical analysis

The data were expressed as the mean and standard deviation (SD). The chi-square test was used for the calculation of significance in the univariate comparison for percentage of satisfaction for clinical outcome, and Student's *t*-test was utilized for each continuous variable. A repeated measurement of ANOVA was also performed to test the difference in cytokine between the two treatment groups. All tests were two-sided, and significance was set at $p < 0.05$ for each test.

3. Statement of ethics

This study was conducted in accordance with the declaration of Helsinki. All human studies have been approved by China Ethics Committee and performed in accordance with the ethical standards.

4. Results

The blood loss pre- and post-operation was different between PELD and OD groups and the difference was significantly statistical ($p < 0.05$). In addition, the hospital stay times was remarkable shorter in PELD group than OD group ($p < 0.05$). Furthermore, the wound size in PELD was significantly smaller than that in OD group ($p < 0.05$) (Table 1).

MacNab satisfaction was used to evaluate postoperative 6-month clinical satisfaction, with a 90% satisfaction in the PELD group (8/10 very satisfied; 1/10 satisfied) and the same satisfaction (90%) in the OD group (7/10 very satisfied, 2/10 satisfied). Meanwhile, the pain index, including preoperative and postoperative VAS, was different in the two groups with no statistical difference ($p > 0.05$) (Table 2).

There was a case of nerve numbness in the PELD group who was self-improved after two weeks treatment; meanwhile, no complication happened in the OD group. Nerve numbness might be caused by the less intervertebral clearance and the bigger oppression of endoscopic tube to part of nerve roots. Neither of the two groups needed blood transfusion.

There was no statistical difference between PELD and OD groups at pre-operation and 1, 6 and 12 h after operation ($p > 0.05$). The CRP level was significantly lower in PELD group than that in OD group at 24 and 48 h after surgery ($p < 0.05$) (Table 3). After the PELD operation, the CRP level was increased firstly, and then was decreased. However, the CRP level was less than 0.5 mg/dl at any time course (Table 3).

Furthermore, before and after corresponding surgery, the CPK levels in PELD and OD groups were significantly different ($p < 0.05$). In detail, the CPK level was lower in PELD group than that in OD group (Table 4). Finally, the IL-6 levels in PELD and OD group were different. Pre-operation and 1 h after surgery, the difference was not significant. However, along with the IL-6 level increased in OD group after operation, the difference between the two groups was remarkable ($p < 0.05$) (Table 5).

Table 1

Comparison of clinical efficacies between open surgery and endoscopic surgery ($\bar{x} \pm SD$).

	OD	PELD	T value	P value
Blood loss (ml)	99 ± 22.33	8.35 ± 2.99	12.72	0.000*
Hospital stay (days)	5.6 ± 1.26	1.9 ± 0.74	7.99	0.000*
Wound size (cm)	4.9 ± 1.29	0.51 ± 0.02	10.80	0.000*

PELD is percutaneous endoscopic lumbar discectomy and OD is the open lumbar discectomy. * $P < 0.05$.

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