

## Original Article

# The effect of percutaneous transforaminal endoscopic discectomy (PTED) on serum inflammatory factors and pain in patients with lumbar disc herniation after surgery

Hongjie Dai<sup>1</sup>, Xu Zhang<sup>2</sup>, Litao Wang<sup>1</sup>, Xianhui Jin<sup>1</sup>, Xiaolei Cui<sup>3</sup>, Shengjie Cui<sup>1</sup>

<sup>1</sup>Department of Osteopathy, Harrison International Peace Hospital, Hengshui, Hebei, China; <sup>2</sup>Department of Orthopaedics, Sichuan Provincial Hospital, Chengdu, Sichuan, China; <sup>3</sup>Department of Orthopaedics, The Fourth People's Hospital of Hengshui City, Hengshui, Hebei, China

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**Abstract:** Objective: The study aims to investigate the effect of PTED on serum inflammatory factors and pain in patients with lumbar disc herniation. Methods: 94 patients with lumbar disc herniation treated in our hospital were enrolled in this study. Patients were randomly divided into group A (n=47) and group B (n=47). Group A were treated with fenestration discectomy, and Group B were treated with PTED discectomy. The general clinical data, the duration of surgery, bleeding amount, the length of hospital stay, and the complications of patients were compared between two groups. The serum level of TNF- $\alpha$  and IL-6 was detected by enzyme-linked immunosorbent assay (ELISA), and the visual analogue score (VAS) between group A and group B was compared by Japanese Orthopaedic Association Scores (JOA). Results: The total duration of surgery, total bleeding amount, and length of hospital stay in group B were less or shorter than those in group A ( $P < 0.001$ ). The TNF- $\alpha$  level, IL-6 level and VAS score after treatment in group B were lower than those in group A ( $P < 0.001$ ). While the JOA score in group B was higher than that in group A ( $P < 0.001$ ); the incidence of adverse complications such as lumbar deformation, aggravate pain and postoperative distasia in group B was lower than that in group A ( $P > 0.05$ ). The quality of life scores in group B were higher than those in group A ( $P < 0.001$ ). Conclusion: In summary, PTED has a better effect on the disease control and pain relief in patients with lumbar disc herniation; it has played a greater role in improving patients' quality of life, which is worthy of clinical promotion.

**Keywords:** PTED, lumbar disc herniation, inflammatory cytokine, pain

## Introduction

Lumbar disc herniation is a common orthopedic disease induced by intervertebral disc degeneration and the exogenic action [1]. The incidence of lumbar disc herniation is increasing by years [2]. At this moment, with the continuous development of society, the morbidity number of lumbar disc herniation boosts and the morbidity population tends to be younger due to people's various bad living habits. Lumbar disc herniation is the main cause of pain in waist and lower extremities. It has a great impact on people's health and quality of life [3]. In order to continuously improve the clinical efficacy of lumbar disc herniation, and increase the quality

of life of patients, effective therapeutic method for patients with lumbar disc herniation has been the priority [4].

For the therapeutic method of patients with lumbar disc herniation, patients with mild symptoms can be relieved by conservative treatment such as drugs. Nevertheless, patients with severe symptoms often need surgical intervention [1, 5]. Traditional fenestration discectomy plays a better role in relieving symptoms for most patients, so it is often used as a traditional surgical method for lumbar disc herniation [6]. However, traditional fenestration discectomy has a large amount of bleeding, excessive postoperative trauma, and inflammatory reaction.

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What's more, sclerotin is easily damaged. Poor prognosis and palindromia are induced among some patients [7]. With the continuous development of medical technology in recent years, minimally invasive technology has been widely used in clinical surgery. PTED has reduced the amount of blood transfusion and trauma area to some extent, which is conducive to the rehabilitation of patients [8]. However, there are few studies on the analysis of serum cytokines in patients with lumbar disc herniation after intervertebral foramen. The effect of intervertebral foramen on serum cytokines is still unclear. This study aims to investigate the effect of PTED on serum inflammatory factors and pain in patients with lumbar disc herniation.

### Materials and methods

#### *General data*

From March 2017 to March 2018, 94 patients with lumbar disc herniation treated in Harrison International Peace Hospital were enrolled in this study. Patients treated with fenestration discectomy were placed into group A, and patients treated with PTED discectomy were included into group B. Among them, there were 27 males and 20 females in group A, with an average age of  $43.29 \pm 10.55$  years old. There were 24 males and 23 females in group B, with an average age of  $42.75 \pm 11.94$  years old. Inclusion/exclusion criteria: Patients diagnosed as lumbar disc herniation were enrolled in the study [9]; patients with other complications (such as ankylosing spondylitis and fracture of lumbar vertebra) were excluded; patients with communication, consciousness, cognition, and other mental disorders were excluded. Before the study, patients and their families were informed in advance and signed a consent form, and the study was approved by the Harrison International Peace Hospital Ethics Committee.

#### *Therapeutic method*

Interlaminar fenestration was performed in Group A. All patients were subjected to general anesthesia and prone position. Patient's intervertebral space was confirmed by C-arm fluoroscopy. After a routine disinfection, a surgical incision (with a length of 3 cm to 4 cm) was performed. The musculus sacrospinalis tissue and multifidus tissue adjacent to the lesion side

were subjected to stripping until the intervertebral space was fully exposed. After the paravertebral muscles were opened by the operator, the rongeur should be used to remove the vertebral plate between the lesion gaps. The nerve hook was used to open the nerve root and dural sac until the intervertebral disc was exposed. The posterior longitudinal ligament and the annulus fibrosus were cut apart, and the nucleus pulposus tissue was removed. Finally, the wound was closed after the use of conventional indwelling drainage tube. The incision was sutured layer by layer. Routine anti-infection treatment was conducted after the end of the surgery.

Patients with lumbar disc herniation in group B were treated with PTED: all patients were subjected to lateral position, with knees and hips bent. Under the check of the C-arm fluoroscopy, the body surface entry point was located; then all the confirmed entry points were carried out by infiltrate anesthesia layer by layer. After the infiltration anesthesia was completed, the PTED was inserted with the help of radiofrequency ablation electrode; then the grasping forceps were used to remove the loose and detached nucleus pulposus tissue, the plump joint capsule and the ligamentum flavum in the visual field.

#### *Outcome measures*

The general clinical data of patients, the total duration of surgery, total bleeding amount, the length of hospital stay, the complications (lumbar deformation, aggravated pain and postoperative distasia) of patients, and the serum inflammatory factor changes were compared between group A and group B (the serum content of TNF- $\alpha$  and IL-6 was detected by enzyme-linked immunosorbent assay (ELISA)). The degree of pain was measured by Visual Analogue scale (VAS) [10]. The score was proportional to the degree of pain. Based on Japanese Orthopaedic Association Scores (JOA), the lower the score was, the lighter the pain would be [11]. The score was inversely proportional to the severity degree. The higher the score was, the lighter the condition would be. The QOL-C30 scale [12] was used to compare the quality of life (including physical health, mental health, material life, social function, the score was

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**Table 1.** General data of the two groups

Group	Group A (n=47)	Group B (n=47)	t/ $\chi^2$	P
Age (years)	43.29±10.55	42.75±11.94	0.233	0.817
gender			0.386	0.535
Female	20 (43.55)	23 (48.94)		
Male	27 (56.45)	24 (51.06)		
BMI (kg/m <sup>2</sup> )	18.24±2.03	19.00±1.28	2.171	0.033
Smoking situation			0.184	0.668
No	16 (34.04)	18 (38.30)		
Have	31 (65.96)	29 (61.70)		
Drinking situation			0.170	0.680
No	25 (53.19)	23 (48.94)		
Have	22 (46.81)	24 (51.06)		
Blood phosphorus (mmol/L)	1.53±0.48	1.73±0.62	1.749	0.084
Renal function				
BUN (mmol/L)	5.90±2.84	4.13±2.56	3.174	0.002
Cr (mmol/d)	4.64±2.38	5.74±2.48	2.194	0.031

**Table 2.** Comparison of surgical conditions between group A and group B patients

Group	Group A (n=47)	Group B (n=47)	t	P
Total duration of surgery (min)	67.15±11.48	60.27±10.52	3.029	0.003
Total bleeding amount (ml)	120.36±37.18	50.18±20.47	11.340	<0.001
Length of hospital stay (d)	8.28±1.24	5.11±1.03	13.480	<0.001

## Statistical methods

SPSS19.0 (Asia Analytics Formerly SPSS China) was used for statistical analysis. The enumeration data was expressed in [n (%)], and the enumeration data between the two groups was tested by  $\chi^2$ ; the measurement data was expressed as mean  $\pm$  standard deviation ( $X \pm SD$ ). The paired t test was used for comparison before and after treatment within the group. The independent sample t test was used for comparison between the two groups. When the P value was less than 0.05, the difference was statistically significant.

## Results

### General clinical data

The general clinical data of the two groups such as age and gender were compared ( $P > 0.05$ ) (Table 1).

### Comparison of surgical conditions

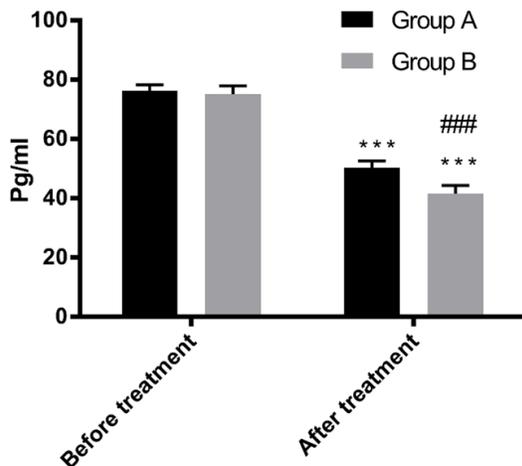
The total duration of surgery, total bleeding amount, and length of hospital stay in group B were less than those in group A ( $P < 0.001$ ) (Table 2).

### TNF- $\alpha$ change before and after treatment in group A and group B

There was no statistical difference in TNF- $\alpha$  between the two groups before treatment ( $P > 0.05$ ); the TNF- $\alpha$  after treatment in group B was lower than that in group A ( $P < 0.001$ ) (Figure 1).

### Changes of IL-6 levels before and after treatment in group A and group B

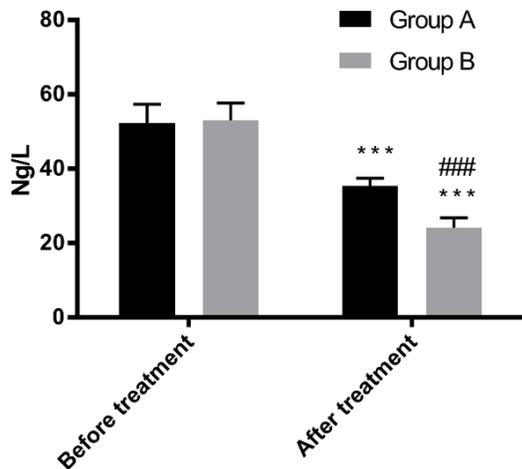
There was no statistical difference in IL-6 between the two groups before treatment ( $P > 0.05$ ); the IL-6 after treatment in group B



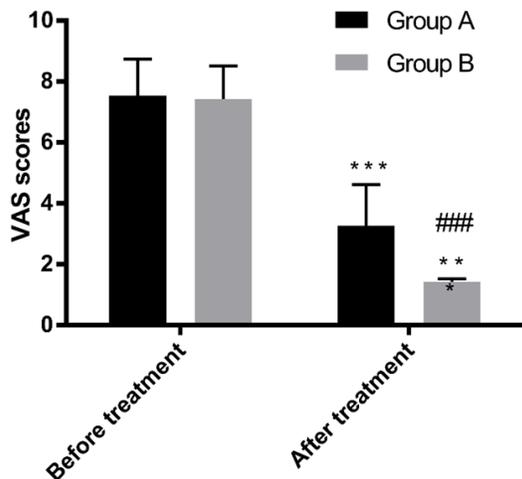
**Figure 1.** TNF- $\alpha$  change before and after treatment in group A and group B. \*\*\* indicated that TNF- $\alpha$  levels after treatment in both groups were lower than those before treatment; ### indicates that TNF- $\alpha$  after treatment in group B was lower than that in group A ( $P < 0.001$ ).

proportional to the quality of life) of patients between group A and group B.

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**Figure 2.** Changes of IL-6 levels before and after treatment in group A and group B. \*\*\* indicated that IL-6 levels after treatment in both groups were lower than those before treatment; ### indicated that IL-6 after treatment in group B was lower than that in group A ( $P < 0.001$ ).

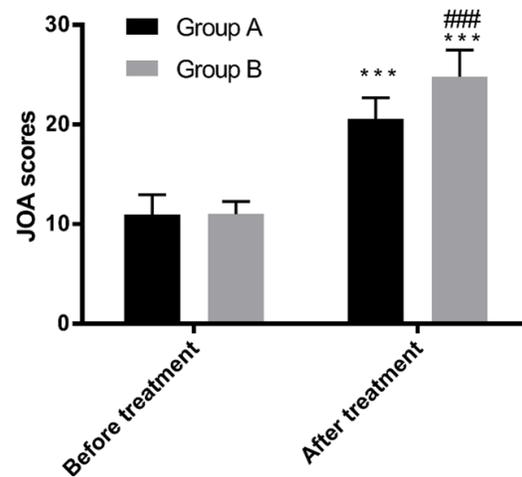


**Figure 3.** Comparison of VAS scores before treatment between group A and group B. \*\*\* indicated that the VAS scores of patients in group A and group B after treatment were lower than those before treatment ( $P < 0.001$ ); ### indicated that the VAS score of group B was lower than that of group A ( $P < 0.001$ ).

was lower than that in group A ( $P < 0.001$ ) (Figure 2).

### Comparison of VAS scores before treatment between group A and group B

The VAS scores of patients in group A and group B after treatment were lower than those before treatment ( $P < 0.001$ ). The VAS score of group B was lower than that of group A ( $P < 0.001$ ) (Figure 3).



**Figure 4.** Comparison of JOA scores before and after treatment between group A and group B. \*\*\* indicated that the JOA scores of patients in group A and group B after treatment were higher than those before treatment ( $P < 0.001$ ); ### indicated that the JOA score in group B was higher than that in group A ( $P < 0.001$ ).

### Comparison of JOA score before and after treatment between group A and group B

The JOA scores of patients in group A and group B after treatment were higher than those before treatment ( $P < 0.001$ ). The JOA score in group B was higher than that in group A ( $P < 0.001$ ) (Figure 4).

### Comparison of complications and quality of life between group A and group B

The incidence of adverse complications such as lumbar deformation, aggravated pain and postoperative distasia in group B was lower than that in group A ( $P > 0.05$ ) (Table 3).

### Comparison of quality of life between group A and group B

The quality of life scores of the physical health, mental health, material life and social function in group B were higher than those in group A ( $P < 0.001$ ) (Table 4).

## Discussion

In this study, we first analyzed the situation during the surgical procedure of patients with lumbar disc herniation. The total duration of surgery, total bleeding amount, and length of hospital stay in group B were less than those in group A. Traditional fenestration discectomy

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**Table 3.** Comparison of complications in patients in group A and group B

Group	Group A (n=47)	Group B (n=47)	X <sup>2</sup>	P
Lumbar deformation	1 (2.13)	0 (0.00)	-	-
Aggravated pain	1 (2.13)	0 (0.00)	-	-
Dystasia	2 (4.26)	1 (2.13)	-	-
Total	4 (8.51)	1 (2.13)	1.901	0.168

**Table 4.** Comparison of quality of life after intervention in group A and group B

Group	Group A (n=47)	Group B (n=47)	t	P
Physical health	56.19±7.44	62.18±5.23	4.516	<0.001
Mental health	63.19±4.29	77.22±5.85	13.260	<0.001
Material life	62.14±5.03	78.36±5.39	15.08	<0.001
Social function	63.46±5.14	72.15±5.06	8.260	<0.001

has a long duration of surgery and a large amount of bleeding. It also brings great damage to soft tissue, nerve root, vertebral plate and ligamentum flavum. What's more, spine stability is damaged, which is not good for the rehabilitation [13]. Therefore, it is believed that PTED can shorten the total duration of surgery, total bleeding amount and length of hospital stay, which is more conducive to the rehabilitation and prognosis of patients. There was no statistical difference in the TNF- $\alpha$  before treatment between group A and group B; the TNF- $\alpha$  level after treatment in group B was lower than that in group A; the IL-6 levels of two groups after treatment were also lower than those before treatment. The IL-6 level after treatment in group B was lower than that in group A, and the difference was statistically significant. In recent years, the relationship between higher levels of inflammatory factors and lumbar disc herniation has been confirmed. The surgical trauma in discectomy can cause inflammatory response in tissue trauma sites [14]. PTED is a perfect combination of new endoscopic technique and traditional open discectomy. It removes the nucleus pulposus of the lesion intervertebral space without paraspinal muscles and nerve damage, and spinal stability disorders. It has the advantages of small systemic inflammation and stress response, and rapid recovery [15, 16]. TNF- $\alpha$  is an important prognosis indicator for evaluating lumbar disc herniation [17]. Studies have shown that excessive

TNF- $\alpha$  can indirectly induce local inflammation and lumbar vertebrae damage [18]. At present, it has been confirmed that during the inflammatory period, the intervertebral disc tissue cells close to the nerve root will secrete a large amount of inflammatory cytokines such as TNF- $\alpha$  and IL-1 $\beta$  [19, 20]. IL-1 $\beta$  and IL-6 belong to the same kind of interleukin proinflammatory cytokine that are widely involved in the human tissue destruction. Related studies have shown that inflammatory cytokine such as TNF- $\alpha$  and IL-1 $\beta$  are markedly increased in severe lumbar disc herniation [21]. Therefore, it is believed that the inflammatory condition is better in patients with PTED, and that TNF- $\alpha$  and IL-6 levels are well down-regulated. Next, the pain relief before treatment was compared between group A and group B. It

was found that the VAS scores after treatment in group A and group B were lower than those before treatment, and the difference was statistically significant. After comparison between two groups, the VAS score in group B was lower than that in group A, and the difference was statistically significant. The JOA scores after treatment in group A and group B were higher than those before treatment, and the difference was statistically significant. After comparison between two groups, the JOA score in group B was higher than that in group A, and the difference was statistically significant. The clinical study of fenestration discectomy showed that the JOA score was up-regulated and the VAS score was down-regulated in patients with lumbar disc herniation. It indicated that the patient's condition was controlled, and the pain was relieved. The advantages of PTED have been confirmed [22, 23]. Similar studies have confirmed a significant positive correlation between VAS scores and interleukin levels; that is, the lower the degree of pain, the lower the level of inflammatory factors [24]. Therefore, we believe that patients undergoing percutaneous transforaminal nucleotomy are more likely to control their disease and relieve inflammation and pain. Therefore, it is believed that the condition of patient with PTED was well controlled and the pain was greatly relieved. Finally, the complications and quality of life were compared between group A and group B. It was found that the incidence of adverse complications such as lumbar deformation, aggravated

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pain and dystasia in group B was lower than those in group A, but the difference was not statistically significant. After comparison between the two groups, the quality of life scores of physical health, mental life, material life and social function in group B were higher than those in group A, and the difference was statistically significant. A large number of similar studies have shown that PTED is carried through a narrow surgical pathway, which can protect soft tissue, nerve roots, vertebral plate and ligamentum flavum, and reduce or avoid adverse complications in traditional fenestration discectomy [24]. Therefore, it is believed that, compared with the traditional fenestration discectomy, PTED can decrease or avoid adverse complications. It can greatly enhance patients' quality of life.

In summary, PTED has a better effect on the disease control and pain relief in patients with lumbar disc herniation. It has played a greater role in improving patients' quality of life, which is worthy of clinical promotion.

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### Disclosure of conflict of interest

None.

**Address correspondence to:** Shengjie Cui, Department of Osteopathy, Harrison International Peace Hospital, No. 180 Renmin East Road, Hengshui 053000, Hebei, China. Tel: +86-1800318865; E-mail: e90waml@163.com

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