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Original article

A retrospective study of epidural and intravenous steroids after percutaneous endoscopic lumbar discectomy for large lumbar disc herniation

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ABSTRACT

Objective: To assess the early curative effect of epidural or intravenous administration of steroids during a percutaneous endoscopic lumbar discectomy (PELD).
Methods: 28 consecutive patients who underwent PELD due to large lumbar disc herniation between November 2014 and January 2016 were followed up for 6 months. These patients were divided into two groups according to the treatment they received after PELD. 14 patients (Group A) were treated by PELD and epidural steroids, while the other 14 patients (Group B) were treated by PELD and intravenous steroids. We evaluated the effectiveness by the preoperative and postoperative visual analogue scale (VAS) scores for back and leg pain, and the postoperative Oswestry disability index (ODI) at 3 weeks after surgery via the clinical charts and telephone interview. Postoperative hospital stay and time return to work were investigated as well.
Results: There is a significant decrease in VAS (back, leg), ODI, and time return to work ($p < 0.05$). For VAS (back), Group A showed a significant decrease compared with Group B at 1 day and 1 week after surgery ($p = 0.011$, $p = 0.017$). As for VAS (leg), Group A showed a significant decrease compared with Group B at 1 day, 1 week, 3 weeks, and 3 months follow-up examinations ($p = 0.002$, $p = 0.006$, $p < 0.001$, $p < 0.001$). For ODI, Group A showed a notable decrease compared with Group B ($p < 0.001$). The postoperative hospital stay in two groups was not statistically different ($p = 0.636$). But the time return to work in Group A was significantly shorter than that in Group B ($p = 0.023$).
Conclusion: Patients who underwent PELD with epidural steroid administration for large lumbar disc herniation showed favorable curative effect compared with those who underwent PELD with intravenous steroid administration.

Introduction

Large lumbar disc herniation is defined as a herniation that occludes more than half of the spinal canal and compresses neural structures (Fig. 1).[1] It usually leads to back pain, radicular pain, and neurological deficits due to nerves compression and inflammatory reactions. Lumbar posterior fusion can depress the spinal cord and nerve root, but the traditional lumbar surgery causes too much tissue damage. With the rapid development of surgical techniques on minimally invasive spine surgery, percutaneous endoscopic procedures for lumbar disc herniation is getting more popular among lumbar surgery. Percutaneous endoscopic lumbar discectomy (PELD) can also sufficiently release nerve root from physical compression of herniated lumbar disc.

Epidural steroids are extensively used in open lumbar discectomy and conservative therapy for lumbar disc herniation because of their anti-inflammatory effects. And epidural steroids are also applied in PELD in recent years. As a simple way, intravenous steroids are more generally administrated in clinical treatment of lumbar disc herniation. There are no studies on the comparative outcome treated by epidural or intravenous steroids in patients undergoing PELD as far as we know.

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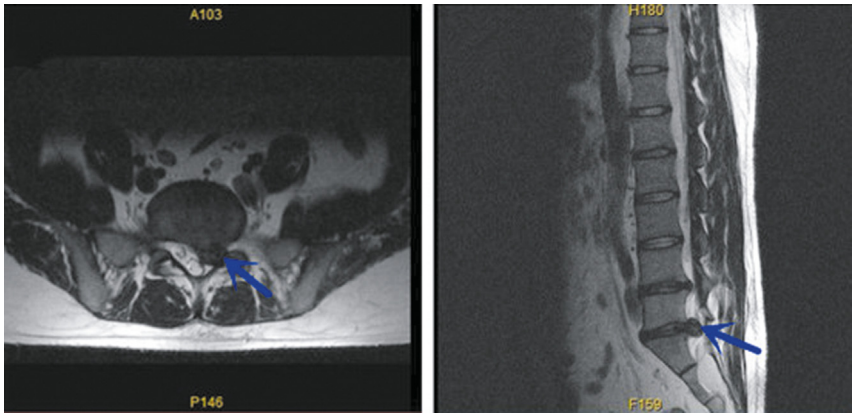

Fig. 1. Preoperative T2-weighted magnetic resonance imaging scans in the axial plane and sagittal plane show a large lumbar disc herniation.

Materials and methods

Patients

This retrospective study involved in 28 consecutive patients who underwent PELD due to large lumbar disc herniation, and the results were statistically analyzed. These patients who received treatments in Shenzhen Second People's Hospital between November 2014 and January 2016 were divided into two groups according to the administration of steroids after PELD. 14 patients (Group A) were given epidural steroids after PELD, while the other 14 patients (Group B) were treated with intravenous steroids after PELD by the same surgeon.

The inclusion criteria are as follows: 1) large lumbar disc herniation that occludes more than 50% of the spinal canal and compresses neural structures, 2) typical symptom of back pain and radicular pain, 3) invalidation of conservative treatment for more than 6 weeks.

The exclusion criteria are as follows: 1) lumbar instability, 2) back pain without radicular pain, 3) lumbar disc herniation accompanying with diabetes mellitus or hematonosis, 4) lumbar spine tumor, infection or other pathologic conditions.

The patients were routinely followed up by telephone, WeChat, and questionnaire at postoperative 1 week, 3 weeks, 3 months and 6 months. 28 patients were investigated in this study. The characteristics of patients were reviewed in detail. Data such as patients' age, sex, occupation, imaging data, visual analogue scale (VAS) scores of back and leg pain, postoperative hospital stay, and time return to work were listed in Table 1.

Surgical technique

PELD was performed under local anesthesia with G-arm. Patients with high iliac crest and L5/S1 disc herniation of axillary type were treated by PELD via the interlaminar approach (IL-PELD).[2–4] And the rest patients via the transforaminal approach (TF-PELD) (Fig. 2).[5–7] After sufficient decompression and epidural pulsating (Fig. 3), a single dose of intravenous or epidural betamethasone was administered: 1 ml of betamethasone was administered via epidural injection to each patient in Group A, while 1 ml of intravenous betamethasone was administered to each patient in Group B. All patients were advised bed-bond for 3 weeks after surgery.

Statistical analysis

The statistical analysis was carried out by using SPSS version 19.0. Student's *t*-test was used to compare the differences between the clinical results of age, VAS scores of back and leg pain, postoperative hospital stay, time return to work, and ODI in the two groups. Chi-square test was used to compare the differences between characteristics of sex, working strength, involved level, and operative approach in two groups. A p value of less than 0.05 was considered statistically significant difference.

Table 1
Characteristics of patients who underwent PELD administrated with epidural or intravenous steroids.

Patients	Group A	Group B	p value
Age (yr)	30.93	30.79	0.976
Male:Female ratio	10:4	11:3	0.999
Working strength			0.999
Light	3 (21%)	4 (29%)	
Medium	11 (79%)	10 (71%)	
Involved level			0.449
L3/4	1 (7%)	0	
L4/5	6 (43%)	9 (64%)	
L5/S1	7 (50%)	5 (36%)	
Operative approach			0.704
TF-PELD	7 (50%)	9 (64%)	
IL-PELD	7 (50%)	5 (36%)	

Results

28 patients were followed up for 6 months. The average age of patients (10 men and 4 women) was (30.93 ± 9.29) years ranging from 18 to 54 in Group A. In Group B, the average age of patients (11 men and 3 women) was (30.79 ± 8.65) years, ranging from 17 to 49. No statistically significant differences between Group A and Group B were found regarding the age, sex, working strength, involved level, and operative approach (Table 1). And the preoperative VAS (back and leg) scores and ODI were not significantly different between the two groups (Table 2).

Mean VAS scores of back pain in Group A at postoperative 1 day, 1 week, 3 weeks, 3 months, 6 months were 1.57 ± 0.76, 1.36 ± 0.75, 1.36 ± 0.50, 1.00 ± 0.56, 0.71 ± 0.47, respectively. Mean VAS scores of back pain in Group B at postoperative 1 day, 1 week, 3 weeks, 3 months, 6 months were 2.50 ± 1.02, 2.07 ± 0.73, 1.64 ± 0.63, 1.29 ± 0.61, 1.14 ± 0.66, respectively. There was a significantly statistical difference of VAS (back) scores at 1 day and 1 week between Group A and Group B ($p = 0.011$, $p = 0.017$) (Fig. 4, Table 2).

Mean VAS scores of leg pain in Group A at postoperative 1 day, 1 week, 3 weeks, 3 months, and 6 months were 1.43 ± 0.65, 1.29 ± 0.61, 0.57 ± 0.76, 0.36 ± 0.50, 0.29 ± 0.47, respectively. Mean scores of leg pain in Group B at postoperative 1 day, 1 week, 3

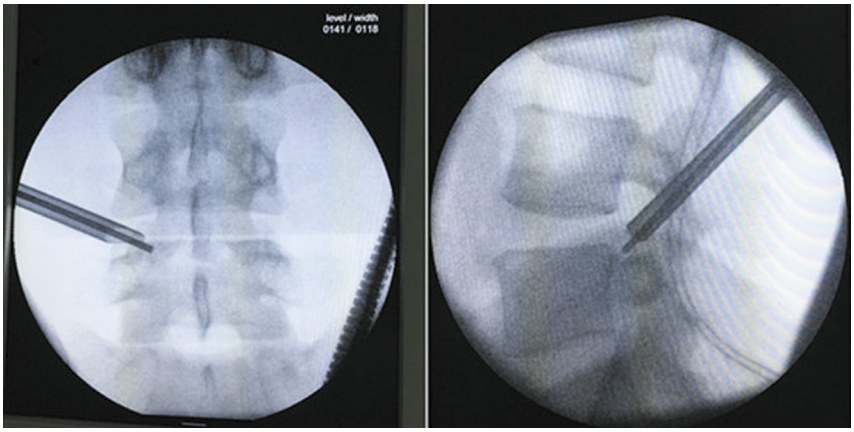

Fig. 2. The spinal needle reached the target point on the anteroposterior and lateral radiography.

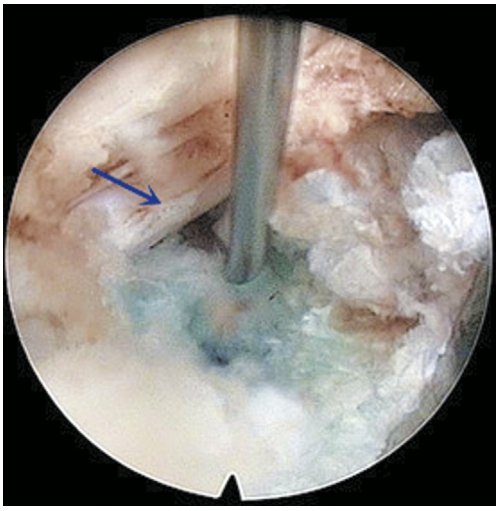

Fig. 3. Nerve root was decompressed completely by exploration.

Table 2
Preoperative and postoperative VAS scores of back and leg, postoperative hospital stay, time return to work, and ODI in Group A and Group B.

Patients	Group A	Group B	*p* value
VAS (back)			
Preop	4.57 ± 1.09	4.50 ± 1.51	0.887
Postop 1d	1.57 ± 0.76	2.50 ± 1.02	0.011
Postop 1w	1.36 ± 0.75	2.07 ± 0.73	0.017
Postop 3w	1.36 ± 0.50	1.64 ± 0.63	0.196
Postop 3m	1.00 ± 0.56	1.29 ± 0.61	0.207
Postop 6m	0.71 ± 0.47	1.14 ± 0.66	0.059
VAS (leg)			
Preop	6.93 ± 1.49	5.71 ± 2.23	0.103
Postop 1d	1.43 ± 0.65	2.64 ± 1.15	0.002
Postop 1w	1.29 ± 0.61	2.29 ± 1.07	0.006
Postop 3w	0.57 ± 0.76	2.00 ± 1.11	<0.001
Postop 3m	0.36 ± 0.50	1.79 ± 1.05	<0.001
Postop 6m	0.29 ± 0.47	1.00 ± 1.24	0.054
Postoperative stay (d)	4.00 ± 2.25	4.36 ± 1.65	0.636
Time return to work (d)	31.21 ± 9.07	44.36 ± 18.18	0.023
ODI			
Preop (%)	60.63 ± 4.81	62.38 ± 4.31	0.321
Postop 3w (%)	16.35 ± 2.24	19.68 ± 1.47	<0.001

Results are the mean ± standard deviation; Preop = preoperative, postop 1d = postoperative 1 day, postop 1w = postoperative 1 week, postop 3m = postop 3 months.

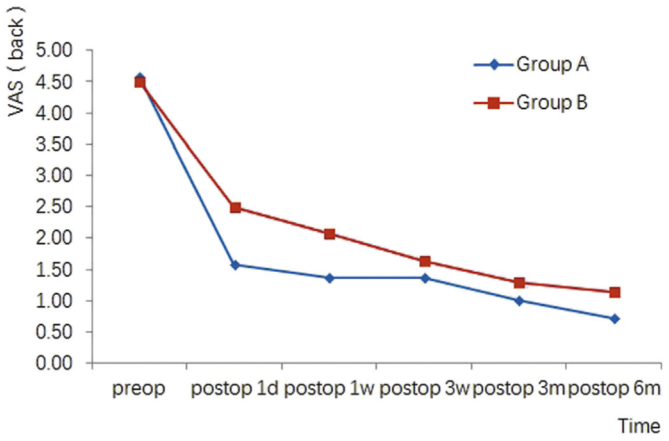

Fig. 4. Mean values of VAS scores of back pain.

weeks, 3 months, and 6 months were 2.64 ± 1.15, 2.29 ± 1.07, 2.00 ± 1.11, 1.79 ± 1.05, 1.00 ± 1.24, respectively. There was a statistically significant decrease in the mean VAS (leg) scores at 1 day, 1 week, 3 weeks, and even 3 months after surgery ($p = 0.002$, $p = 0.005$, $p < 0.001$, $p < 0.001$, Fig. 5).

The mean postoperative hospital stay was (4.00 ± 2.25) day and (4.36 ± 1.65) day in Group A and Group B respectively, and there was no statistically significant difference in two groups (Fig. 6). But

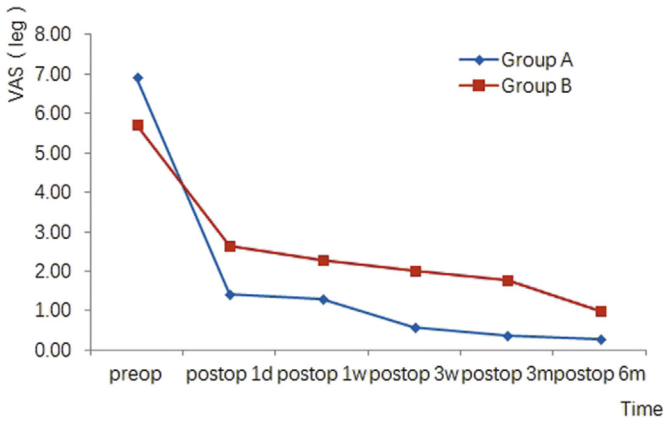

Fig. 5. Mean values of VAS scores of leg pain.

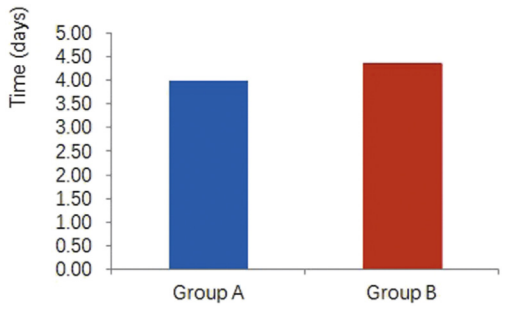

Fig. 6. Mean values of postoperative hospital stay.

there was a statistically significant decrease in the time return to work in Group A compared with Group B ($p = 0.023$). The mean periods of time return to work were (31.21 ± 9.07) days and (44.36 ± 18.18) days (Fig. 7).

The mean values of ODI in Group A were 60.63% ± 4.81% and 16.35% ± 2.24% before operation and 3 weeks after surgery, respectively. The mean values of ODI in Group B were 62.38% ± 4.31% and 19.68% ± 1.47% before operation and 3 weeks after surgery, respectively. And there was a statistically significant difference between the two groups ($p < 0.001$, Fig. 8).

A 17-year-old patient with L5/S1 large disc herniation underwent revision surgery. PELD was performed one year later since the first operation. The main complications[8,9] such as postoperative infection, dural tear, and temporary nerve root injury were not found in our patients in either group.

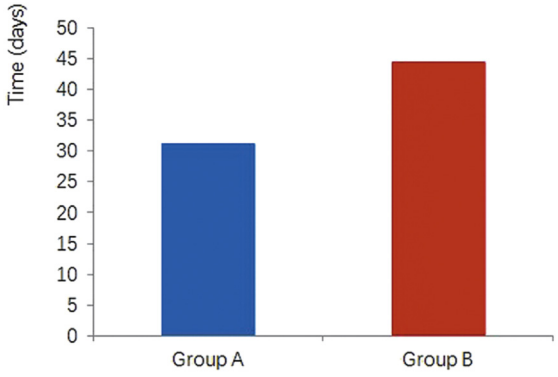

Fig. 7. Mean values of time return to work.

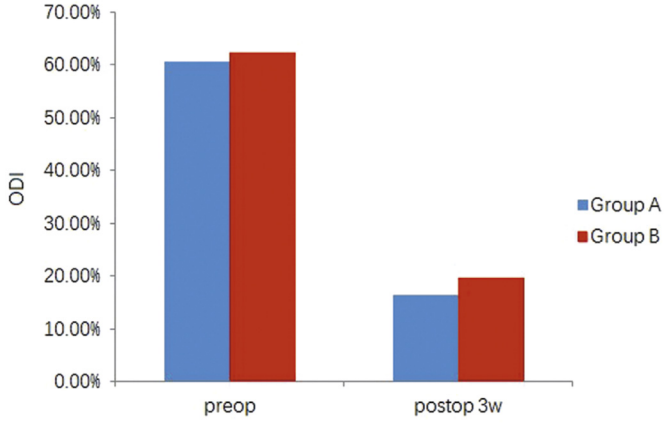

Fig. 8. Mean values of ODI.

Discussion

Steroids can relieve inflammatory reaction by suppressing chemotaxis aggregation of inflammatory cells, adhesion of leucocytes, and release of histamine and kinin. Steroids have been shown to be capable of decreasing the activity of phospholipase A_2, blocking nociceptive C-fiber conduction, stabilizing cell membranes and inhibiting prostaglandin synthesis as well.[10] Large lumbar disc herniation usually leads to back pain, leg pain, foot drop, dysesthesia, and even cauda equine syndrome. On one hand, neural structures which are chronically compressed by nucleus pulposus physically get edema and denaturation. On the other hand, inflammatory factors released by cracked annulus fibrous can stimulate nerve root and local tissue. Therefore, steroids have significant effects on treating lumbar disc herniation. During surgery, nerve root irritation by radiofrequency ablation electrode may lead to some complications, such as numbness and paraesthesia. And there are some risk factors for recurrence after successful PELD.[11,12] Epidural and intravenous steroid administration after PELD can avoid some complications and recurrence to a certain degree, especially for the patients with short duration of symptoms and huge disc herniation.

This study demonstrated that patients who received epidural steroids after PELD exhibited greater reduction in pain and shorter time return to work compared with intravenous steroids after PELD. Epidural and intravenous steroids after PELD were extensively applied in clinical treatment, but no report has been made on comparison between them. Only one study has investigated the effects of epidural steroids after PELD before this study. Their randomized controlled study concluded that epidural steroids after PELD improved clinical effect and functional outcomes in the short-term surgery.[13] And a large number of samples and randomized controlled studies made the conclusion more convincing.

In this study, epidural steroids after PELD relieved back and leg pain, shortened the time return to work, and improved the function. The following points on administration of steroids shall be taken into account.

First, patients with lumbar disc herniation (LDH) have many options of the treatment according to different types and stages. As a chronic degenerative disease, LDH can be treated with rest, nonsteroidal anti-inflammatory drugs, transforaminal epidural steroid, minimally invasive surgery, open traditional discectomy and so on. The conception of step-up therapy is quite recommended for the treatment of LDH. Liu et al[14] reported a case that had a large LDH resorbed spontaneously within 4 months by conservative treatment. A 48-year-old man with low back and right leg pain for 20 days was treated with bed rest, steroidal anti-inflammatory drugs for 2 months and oral administration of Chinese medicine for 4 months. 4 months later, he was re-examined and had no complaints, and the second MRI showed complete disappearance of the extruded fragment. Transforaminal epidural steroid is an effective tool for managing sciatica.[10] If conservative treatment is invalid, PELD may be a preferred option for LDH. Minimally invasive surgery in conjunction with steroids may achieve better effect. Besides, it is important to find an optimal timing for PELD and administration of steroids. Wang et al[15] concluded that steroids play a notable role in the treatment of LDH at early stage.

Second, epidural injection becomes more convenient after PELD. When the 18-gauge spinal needle reached the final point, the depth was recorded with a mark. The mark and gelatin sponge put on the surface of dural sac can avoid dural tear which is one of the complications or nerve root lesion. Gelatin sponge can also avoid steroids leakage and infiltration of local tissue efficiently. 1 ml of betamethasone was administered by epidural injection in this study. In the study of Owlia MB et al[16] epidural steroid injection

with low dose (40 mg) methylprednisolone was as effective as high dose (80 mg).

Third, steroids are divided into 3 categories according to their half-life period: long acting, intermediate acting, and fast acting steroids. The half-life of long acting steroids such as betamethasone and dexamethasone is about 36–54 h; the half-life of intermediate acting steroids such as triamcinolone, prednisolone, and methylprednisolone is about 12–36 h; and the half-life of fast acting steroids such as cortisone and hydrocortisone is about 8–12 h. Betamethasone as a long acting steroid was used in this study. McCormick et al[17] reported that triamcinolone showed more obvious pain relief than betamethasone. It needs further study on the comparison between intermediate and long acting steroids in the treatment of lumbar disc herniation.

Unreasonable administration of steroids may cause some adverse reactions. Ahn et al[18] reported that 0.12% of 9821 patients had spondylodiscitis followed by transforaminal percutaneous endoscopic lumbar discectomy. And Lowell et al[19] reported that three patients undergoing open discectomy got infected after administration of perioperative steroids. Infections are rarely seen owing to the measures of continuous irrigation, prophylactic antibiotics, minimal tissue damage[20] and short surgery time. Other adverse effect such as osteoporosis is rare. The dose of steroids needs to be assessed by individual factors such as body mass index.

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