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Original Article

The clinical efficacy of simple nucleotomy on single-segment lumbar disc herniation using a microscope and full-endoscope

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Abstract: Background: Lumbar disc herniation (LDH) is one of the most common causes of low back pain (LBP) and corresponding neurological symptoms in the innervation area. In this retrospective study, we assessed the clinical efficacy of simple nucleotomy on single-segment LDH using a microscope and full-endoscope. Patients and methods: In the current study we reviewed 130 patients who underwent simple nucleotomy in our hospital during the period of Jan. 2016-Dec. 2018. According to the surgical approaches, they were divided into two groups, microdiscectomy (MD; n=64) and full-endoscopic lumbar discectomy (FELD; n=66). All the patients were followed up from 15 to 33 months, with an average of 23.6 months. Serum creatine phosphokinase (CPK) content was measured to estimate the degree of paravertebral muscle injury after surgery. The clinical efficacy was evaluated by Japanese Orthopaedic Association (JOA) score, Oswestry Disability Index (ODI), and Visual analogue scale (VAS) score. In both groups, there was no nerve root injury, dural tear, infection, and lumbar intervertebral instability. Results: The serum CPK content was found to be much higher in the MD group than in the FELD group on the second postoperative day (P<0.001). One year later, in both groups, the JOA score was significantly higher than before surgery (P<0.001), while the ODI (P<0.001) and VAS score of the back (P<0.001) and leg (P<0.001) were significantly lower than before surgery. Compared with the FELD group, the MD group showed a significant increase in intraoperative bleeding (P<0.001), incision length (P<0.001) and hospital stay (P<0.001), and a significant decrease in intraoperative time (P<0.001) and intraoperative X-ray fluoroscopy frequency (P<0.001). There was one case of recurrence in the FELD group, who was discharged after conservative treatment; and one case of endoscopic surgery failure, who underwent a second revision using a microscope. Conclusion: To treat single-segment LDH, simple nucleotomy under the microscope and full-endoscope can have good efficacy. The superiority of FELD is indicated by less trauma, less bleeding, and shorter hospital stay; it is especially suitable for the herniated location at the level of disc and suprapedicle. However, the MD can have such advantages as shorter intraoperative time, less intraoperative X-ray fluoroscopy frequency; this is suitable for any location of a herniated disc, especially for the herniated location at the level of infrapedicle and segment of L5/S1.

Keywords: Lumbar disc herniation, microscope, full-endoscope, simple nucleotomy, single-segment

Introduction

Lumbar disc herniation (LDH) is one of the most common degenerative diseases of the spine, often causing low back pain (LBP) and corresponding neurological symptoms in the innervation area [1]. Generally, surgical treatment is required if initially conservative treatment, which lasts 3-6 months, is invalid [2]. In 1977, the nucleus pulposus was first reported to be removed under the microscope [3, 4]. Although it is still regarded as the gold standard for the surgical treatment of LDH [5], there can still be some complications such as lumbar intervertebral instability caused by excision of the articular joint and extensive epidural fibrosis [6]. Since the application of full-endoscopic technology in recent years [7, 8], the treatment has become more mature, with the characteristics of local anaesthesia, less trauma, less bleeding, fast recovery, and shorter hospital stay [9]; however, there may still be risks of nerve root

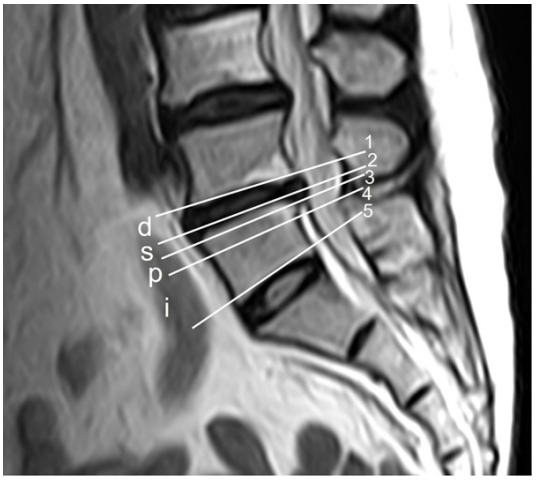

Figure 1. Measurement of the disc herniation on the sagittal section. Extent of the herniation determined as four zones: d = disc level, the zone between line 1 and 2; s = suprapedicle, the zone between line 2 and 3; p = pedicle, the zone between line 3 and 4; and i = infrapedicle, the zone between line 4 and 5.

injury, dural tear and postoperative recurrence [2]. To further explore the efficacy and indications of the two surgical interventions to treat LDH, we made a retrospective analysis of the surgeries from Jan 2016 to Dec 2018 in our hospital, which involved a total of 130 patients with single-segment LDH who had undergone simple nucleotomy, making a comparison of the clinical efficacy of the two surgical approaches.

Patients and methods

Patients

From Jan 2016 to Dec 2018, a total of 130 patients were treated for single-segment LDH in the Department of Orthopedics in our hospital. The diagnosis was made based on their clinical symptoms and signs, and imaging examinations. The initially conservative treatment lasted 3-6 months, which turned out to be ineffective. According to the surgical approaches, the cases were divided into two groups: microdiscectomy (MD) group aged 27-66, with an average of 47.63±11.26 years, and full-endoscopic lumbar discectomy (FELD) group aged 26-69, with a median of 50.5 years (P_{25}: 38.75, P_{75}: 58.25). The patients numbered 64 in MD group and 66 in FELD group.

Inclusion and exclusion criteria

Inclusion criteria: (1) Symptoms of chronic radiculopathy, with the pain lasting over 3 months and failure to improve on the conservative treatment (e.g., physical therapy, medication, epidural injection); (2) Magnetic resonance images demonstrating single-segment LDH; (3) No history of lumbar infection, fracture of lumbar vertebra, tumor, spondylolisthesis at grade two, or lumbar spinal stenosis; (4) No previous lumbar surgery at the same disc level; (5) An informed consent signed for the surgical treatment.

Exclusion criteria: (1) LDH with two or more segments; (2) Lumbar spondylolisthesis and unstable segments; (3) An insufficient postoperative follow-up; (4) Evidence of a gross scoliosis curve; (5) A history of a mental disorder or lower limb musculoskeletal injuries.

The implementation of the research was approved by the local Medical Ethics Committee in Shanghai Pudong New Area Gongli Hospital (GLYYIs2021-028), and all the research was performed in accordance with the 1964 Helsinki declaration. Written informed consent was obtained from all the participants and/or their legal guardians.

Surgical approaches

At the time of admission, all the relevant examinations had been performed, such as routine X-ray radiography, three-dimensional computed tomography reconstruction and magnetic resonance imaging (MRI) examination of the lumbar spine. The area of disc herniation on the sagittal section was calculated based on the largest observable area of soft tissue herniated (**Figure 1**) [10]. Thanks to a joint consultation with three senior spine surgeons, the segment, type, and location of LDH were identified.

Microdiscectomy: All the operations were performed under general anaesthesia with the patients positioned prone. The position of the intervertebral space at the level of the herniated disc was determined by a guide wire under an image intensifier (anteroposterior view). Then, the following steps were performed [11]: (1) A skin incision of 3 cm longitudinal and posterior median was made; (2) Skin and subcutane-

ous tissues were incised layer by layer to paravertebral muscle on the symptomatic side; (3) The surgical performance was conducted under the microscope; (4) The upper vertebral body of intervertebral space was carefully excised with a few lamina to expose the vertebral canal; (5) A stripper was used to explore the nerve root compressed by herniated nucleus pulposus; (6) Forceps were used to remove the herniated nucleus pulposus tissues; (7) The nerve root was confirmed to be released without active bleeding and residual disc tissues at the surgical site; (8) The wound was rinsed and closed layer by layer and the surgical instruments were checked.

Full-endoscopic lumbar discectomy: During the procedure, the patient lay prone under the local anaesthesia with 1% lidocaine so that they were conscious of the surgeons. Fluoroscopy was employed to determine the surgical segment. Afterwards, an 18-gauge spinal needle was introduced into the annulus fibrosus along a track of 15-30 degrees from the sagittal plane of the body under the guidance of fluoroscopy. The needle tip was located on the lateral side of the facet joint in the anteroposterior view and the upper part of the anterior superior facet joint in the lateral view. Then, the following steps were performed [12]: (1) A guide wire was introduced into the spinal needle before it was removed; (2) A skin incision was made at the incision point marked previously; (3) The superior facet joint was cut stepwise with the guide wire grinding drill, the anterior position not exceeding the inner edge line of the pedicle, and the lateral position not exceeding the posterior edge of the vertebral body; (4) An endoscopic sleeve was connected and inserted into the responsible intervertebral disc; (5) The herniated nucleus pulposus tissues were removed with the endoscopic forceps; (6) Electrocoagulation for hemostasis was performed under endoscopic radiofrequency to ensure no active bleeding; (7) No residual disc tissues were detected around the released nerve root; (8) The endoscope was withdrawn, before the incision was closed with a sterile suture.

Postoperative treatment

After the operation, the patients were required to rest in bed and treated for swelling and neurological symptoms. On the third postoperative day, the patients were encouraged to practice walking with waist protection, followed by a properly increasing amount of daily activity. As required, the patients were instructed to avoid weight-bearing on the waist and back, and not to engage in vigorous physical exercise within three postoperative months.

Creatine phosphokinase (CPK)

The content of serum CPK was detected on the second postoperative day [13].

Efficacy evaluation

Japanese Orthopaedic Association (JOA) score [14]: An evaluation was made of LBP, subjective symptoms, objective findings, daily life limitations and bladder function assessment, with the scoring ranking from the lowest of 0 to the highest of 29 points. The lower the score, the more obvious the dysfunction.

Oswestry disability index (ODI) [15]: The lumbar function and short-term postoperative efficacy were evaluated, which involved a total of 10 items, each ranging from 0 to 5 points. The highest score was 50 points, ODI = actual score/50*100%. The higher the score, the more obvious the dysfunction.

Visual analogue scale (VAS) score [16]: The pain degrees in the waist, leg and wound were assessed; ten points representing the most severe, and 0 points, no pain.

Intraoperative time, intraoperative bleeding, incision length, intraoperative X-ray fluoroscopy frequency, hospital stay and complications: The differences in perioperative indexes such as intraoperative time, intraoperative bleeding, incision length, intraoperative X-ray fluoroscopy frequency, length of hospital stay, and complications were to be observed.

Statistical methods

The normally distributed data were expressed as mean ± standard deviation, and the non-normally distributed data were expressed as median (P_{25}, P_{75}). The statistical analysis was performed using SPSS software v.27.0 (IBM, New York, United States). Independent *t* tests and Mann-Whitney *U* tests were applied to the inter group comparison based on data distribu-

Table 1. General information between the two groups

Item	MD (n=64)	FELD (n=66)	*P* value
Gender (Male/Female)†	30/34	34/32	0.597
Age (yrs)‡	47.63±11.26	50.5 (38.75, 58.25)	0.706
Type of herniation on sagittal section†			<0.001#
disc	26 (40.6%)	45 (68.2%)	
suprapedicle	8 (12.5%)	16 (24.2%)	
pedicle	17 (26.6%)	0 (0%)	
infrapedicle	13 (20.3%)	5 (7.6%)	
Surgical segment†			0.653
L3/4	18 (28.1%)	17 (25.8%)	
L4/5	29 (45.3%)	35 (53.0%)	
L5/S1	17 (26.6%)	14 (21.2%)	

†chi-square tests; #Indicating significant difference in inter group comparison; ‡Mann-Whitney *U* tests.

Table 2. Comparison of serum CPK content between the two groups before and one year after surgery (U/L)

Parameter	MD (n=64)	FELD (n=66)	*P* value
Preoperative	135.42±49.13	129.73±38.87	0.587※
Postoperative	855.40 (753.15, 964.55)	566.92±97.64	<0.001#
P value	<0.001$	<0.001$	

※Independent *t* tests; Mann-Whitney *U* tests: #Indicating significant difference in inter group comparison of postoperative values; Paired *t* tests: $Indicating significant difference in intra group comparison of postoperative and preoperative values within each group respectively.

tion. Paired *t* tests and Wilcoxon signed ranks tests were applied to the intra group comparison based on data distribution. For the categorical variables, chi-square tests or Fisher's exact tests were performed between the two independent groups, with $P<0.05$ considered as statistically significant.

Results

General information

No significant differences were observed in gender, age, or surgical segments between the two groups ($P>0.05$; **Table 1**). A significant difference was observed in the type of herniation on sagittal sections between the two groups, with the lower percent at the level of disc and suprapedicle, and the higher percent at the level of infrapedicle in the MD group than that in the FELD group ($P<0.001$; **Table 1**).

Follow-up period

All the patients were followed up from 15 to 33 months, with an average of 23.6 months.

Serum CPK content test

On the second postoperative day, the serum CPK content was significantly higher in both groups than that before surgery, and it was significantly higher in the MD group than in the FELD group ($P<0.001$; **Table 2**).

Efficacy evaluation

JOA score, ODI and VAS score: The postoperative JOA score of the MD group ($P<0.001$) and the FELD group ($P<0.001$) was significantly higher than that before surgery, respectively (**Table 3**). The postoperative ODI of the MD group ($P<0.001$) and the FELD group ($P<0.001$) was significantly lower than that before surgery, respectively (**Table 3**). The postoperative VAS score of the back ($P<0.001$) and leg ($P<0.001$) in the MD group, and the postoperative VAS score of the back ($P<0.001$) and leg ($P<0.001$) in the FELD group were significantly lower than that before surgery, respectively (**Table 3**). The preoperative VAS score of the leg in the MD group was significantly higher than that in the FELD group ($P<0.01$), whereas no significant difference was observed in postoperative VAS score of the leg ($P>0.05$) between the two groups (**Table 3**). The postoperative JOA score was significantly lower in the MD group than in the FELD group ($P<0.05$), whereas no significant difference was observed in preoperative JOA score ($P>0.05$) between the two groups (**Table 3**). Additionally, between the two groups no significant difference was observed in the

Table 3. Postoperative efficacy comparison between the two groups

Parameter	MD (n=64)	FELD (n=66)	*P* value
Preoperative JOA	9 (8, 11)	9 (8, 10)	0.251
Postoperative JOA	24 (23, 24)*	24 (23.75, 24.25)*	0.015#
Preoperative ODI	76 (61, 85)	77.5 (61.25, 87.25)	0.829
Postoperative ODI	24 (16.25, 27)*	23±9$	0.300
Preoperative VAS of back	5 (4, 6)	5 (4, 5)	0.077
Postoperative VAS of back	1.5 (1, 2)*	1 (1, 2)*	0.717
Preoperative VAS of leg	6 (6, 7)	6 (6, 6)	0.008#
Postoperative VAS of leg	2 (1, 2)*	2 (1, 2)*	0.218

Mann-Whitney *U* tests: #Indicating significant difference in inter group comparison of postoperative and preoperative values respectively; Wilcoxon signed ranks tests: *$P<0.001$, Indicating significant difference in intra group comparison of postoperative and preoperative values within each group respectively; Paired *t* tests: $$P<0.001$, Indicating significant difference in intra group comparison of postoperative and preoperative values.

Table 4. Comparison of the perioperative indexes between the two groups

Parameter	MD (n=64)	FELD (n=66)	*P* value
Intraoperative time (min)‡	42 (34.25, 60)	50.5 (46.75, 75.75)	<0.001#
Intraoperative bleeding (ml)‡	31 (21, 36)	13 (12, 17)	<0.001#
Incision length (cm)‡	2.6 (2.3, 2.8)	0.5 (0.5, 0.725)	<0.001#
Intraoperative X-ray fluoroscopy frequency‡	3.5 (3, 5)	22 (19, 25.25)	<0.001#
Hospital stay (d)‡	6 (5, 8)	3 (2.5, 4)	<0.001#

‡Mann-Whitney *U* tests: #Indicating significant difference in inter group comparison.

preoperative and postoperative ODI and VAS score of the back, respectively ($P>0.05$; **Table 3**).

Intraoperative time, intraoperative bleeding, incision length, intraoperative X-ray fluoroscopy frequency and hospital stay: The intraoperative time and the intraoperative X-ray fluoroscopy frequency were significantly shorter and lower, respectively, in the MD group than those in the FELD group; while there were significant decreases in intraoperative bleeding, incision length and hospital stay in the FELD group when compared with the MD group ($P<0.001$; **Table 4**).

Typical cases of complications

At the time interval of one-year postoperative follow-up, one patient of recurrence in the FELD group was discharged after the conservative treatment (**Figure 2**); one patient failed endoscopic surgery to undergo a second revision under the microscope (**Figure 3**). There was no postoperative recurrence or secondary revision surgery in the MD group.

Discussion

The microscope was first applied to lumbar discectomy in the 1970s [3, 4]. Compared with open surgery under the naked eye, the microscope has obvious advantages in spinal surgery [17], which is still the gold standard for the surgical treatment of LDH [5]. The full-endoscope, which has been applied to lumbar discectomy since the beginning of the 21st century [7, 8], has the advantages of less trauma, less bleeding and shorter hospital stay [9]. These two surgical techniques work differently, having many differences in the specific surgical procedures. The main differences between the microscope and full-endoscope are as follows: (1) Imaging: the former is a three-dimensional imaging, and the latter is a two-dimensional plane; (2) Surgical mode: the former is direct vision, and the latter is reverse video; (3) Surgical field of view: the former is large, and the latter is small; (4) Surgical space: the former is sufficient, and the latter is limited; (5) Surgical cooperation: the former can cooperate tacitly in the same field of view by two surgeons, and the latter is completed independently; (6)

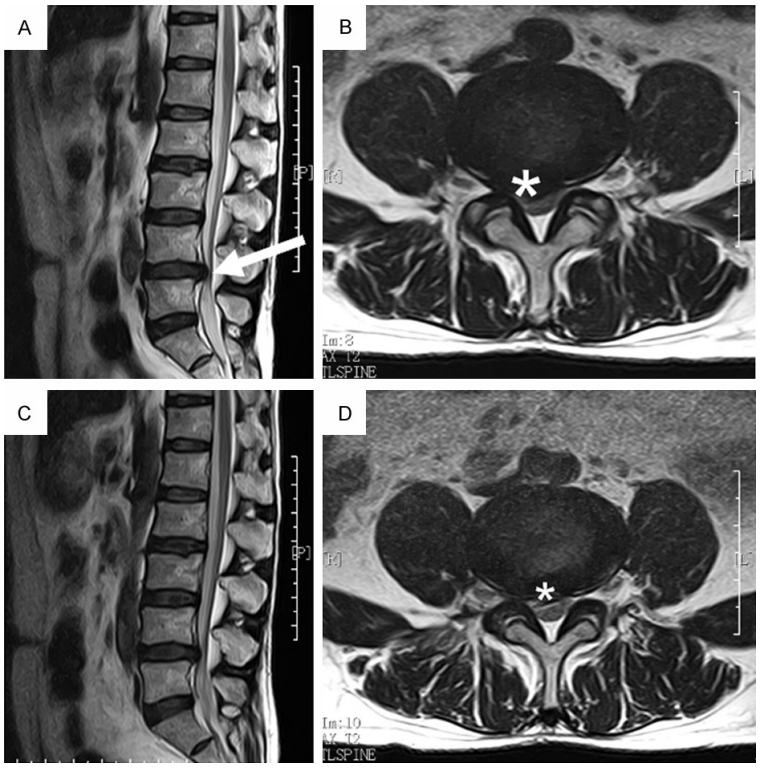

Figure 2. Postoperative recurrence of L4/5 nucleotomy by full-endoscope A. Preoperative MRI sagittal image showing lumbar disc herniation of the L4/5 level (long arrow); B. Preoperative MRI cross-sectional image showing lumbar disc herniation of the L4/5 level at the right side (large asterisk); C. Postoperative MRI sagittal image showing mild lumbar disc herniation of the L4/5 level (short arrow); D. Postoperative MRI cross-sectional image showing small nucleus pulposus fragments on the right side (small asterisk).

The indications for surgery of the former are much broader than the latter [18, 19].

At the time interval of 1-year follow-up in this study, the JOA score, ODI and VAS score of the leg and back in the two groups were significantly improved when compared with those before surgery (P<0.001). No significant differences were observed in the JOA score, ODI and VAS score of the back and leg between the two groups whether before or one year after surgery, except the higher preoperative VAS score of the leg and lower postoperative JOA score in the MD group than those in the FELD group. In the MD group, the higher preoperative VAS score of the leg, indicated, to some extent, that we were inclined to treat those who had severer leg pain caused by LDH using MD for its thorough and complete decompression effect; in the FELD group, the higher postoperative JOA score could be ascribed to the bias and small sample size, having the advantages of less trauma and bleeding, and lower preoperative VAS scores of the leg. There were no such complications as nerve root injury, dural tear, infection, and lumbar intervertebral instability in both groups, which suggested that both the microscope and full-endoscope are safe and effective in treating LDH.

The previous comparative studies (**Table 5**) have reported smaller incision length [6, 20-23], reduced blood loss [20, 23], shorter hospital stay [20-22], faster recovery [22, 23], and quicker return to work [22, 23], in the case of the full-endoscopic discectomy technique, which were consistent with our current ones (**Table 4**). Moreover, the probability of postoperative residual and recurrence of LDH in FELD was much higher than that in MD in the past six years [6, 20-23]. It was difficult for FELD to achieve sufficient decompression in patients with ossification of posterior longitudinal ligament (OPLL), vertebrae posterior marginal osteoproliferation, or lumbar stenosis; yet which may be more suitable for MD [24]. In addition, the location of LDH on the sagittal section of MRI may affect the choice of surgical approaches [25]. We attempted to explore the indications of surgical options according to the morphology of LDH categorized based on sagittal section of MRI [10] between the techniques of MD and FELD, the results of which suggested that both MD and FELD could produce satisfactory clinical outcomes in the treatment of single-segment LDH after surgery. FELD, which has the advantages of less trauma, less bleeding, shorter hospital stay, and is especially suitable for the herniated location at the level of disc and suprapedicle (**Figure 1**); while MD, which has the advantages of shorter intraoperative time, less intraoperative X-ray fluoroscopy frequency, is suitable for any location of the herni-

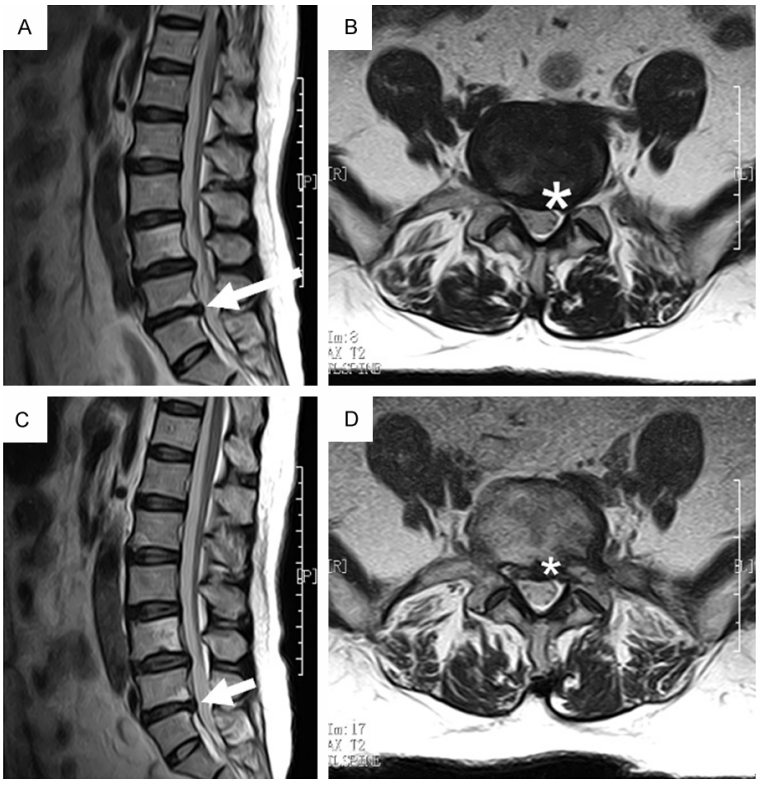

Figure 3. Surgical failure of L5/S1 nucleotomy by full-endoscope. A. Preoperative MRI sagittal image showing lumbar disc herniation of the L5/S1 level (long arrow); B. Preoperative MRI cross-sectional image showing lumbar disc herniation of the L5/S1 level on the left side (large asterisk); C. Postoperative MRI sagittal image showing lumbar disc herniation of the L5/S1 level (short arrow); D. Postoperative MRI cross-sectional image showing residual nucleus pulposus fragments on the left side (small asterisk).

ated disc, especially for the herniated location at the level of infrapedicle (**Figure 1**).

Previous studies have shown that serum CPK content increased most significantly during the lumbar spine fusion surgery, and also did so, to varying degrees, during the minimally invasive lumbar spine surgery [26], and generally returned to the normal within a week after surgery [13]. This study showed that on the second postoperative day, the serum CPK content in both two groups was significantly higher than before ($P<0.001$), respectively. The increased value of the MD group was significantly higher than that of the FELD group, with the difference being statistically significant, which was essentially consistent with the previous research results [26].

Serum CPK content is a sensitive indicator of evaluating the degree of paravertebral muscle injury after a spinal surgery. As previously reported, the postoperative serum CPK content of male patients was much higher than that of female ones, because of their higher muscle tissue content [27]; in this study, however, no significant difference was found between the serum CPK content of the males and females, either before or after surgery. As to those who have a high risk of lumbar spine surgery, a study suggested taking dynamic and systematic measurements of CPK content and establishing a standard measurement interval to assess the degree of muscle injury effectively [28]. This merits further research in the future.

FELD surgery is excellent for the treatment of LDH [29], but postoperative recurrence and failure of endoscopic surgery can occur [30]. Postoperative recurrence, one of the most common complications of FELD surgery, is generally defined as the protrusion of the intervertebral disc in the same area, which has to be surgically removed despite a period of improvement of the postoperative symptoms, with an incidence of approximately 5.8-6.2% [12, 31, 32]. As the most heavily loaded segment, the recurrence rate of the L4/5 disc herniation is the highest after FELD, but it may also be related to the fact that most surgical segments of FELD are at the L4/5 level [33]. In this study, there was only one case of recurrence in the FELD group, an elderly man accidentally sprained his waist more than one month after simple nucleotomy of L4/5 disc herniation, developing the same symptoms as the preoperative ones. In this case, he rejected the second revision and was discharged after a conservative treatment.

The definition of endoscopic surgery failure is as follows: (1) Persistent postoperative neurostimulation symptoms within two weeks which require a second revision surgery; (2) No sig-

Table 5. Baseline characteristics of the comparative studies

Study ID	Study type	Sample size (FELD/MD)	Surgical segment	Complications	Evaluation index	Inclusion criteria	Statistical methods	Main findings
Yu. et al., 2021 [20]	Retrospective	1053 (632/421)	L3/4 L4/5 L5/S1	Transient dysesthesia, residue or recurrence, nerve root injury, dural tear, wound complications	ODI, VAS, patient satisfaction rate	Single-level LDH, symptomatic back pain and/or radiating leg pain, failed cons. Rx at least 6 weeks	Wilcoxon and Mann-Whitney *U* tests	FELD superior to MED for the benefits of lesser invasion, shorter hospital stays, and quicker pain relief and functional recovery
Meyer. et al., 2020 [6]	RCT	47 (23/24)	L1/2 L2/3 L3/4 L4/5 L5/S1	Dural lesion, postoperative infection, recurrence	ODI, VAS (back and leg)	Aged 18-70, confirmed by imaging, failed cons. Rx at least 6 weeks	χ^2 test and ANOVA	FELD results similar to those of conventional MD regarding pain and disability improvement; FELD as a safe and efficient alternative to MD
Gibson. et al., 2017 [21]	RCT	140 (70/70)	L3/4 L4/5 L5/S1	Headaches, mild dysaesthesia	ODI, VAS, patient satisfaction, SF-36	Aged 25-70, single level LDH, failure of cons. Rx	Parametric (unpaired T tests) and non-parametric (Mann-Whitney *U*) tests, Chi-square or Fisher's exact test, ANOVA and paired *t* tests	Functional improvements maintained for 2 years in both groups with less ongoing sciatica after FELD; a greater revision rate after FELD offset by a more rapid recovery
Choi. et al., 2016 [22]	Retrospective	43 (20/23)	L2/3 L3/4 L4/5 L5/S1	No	ODI, VAS (back and leg), radiological outcomes, patient satisfaction rate	LLDH that occupied > 50% of the spinal canal, failed cons. Rx at least 6 weeks	Fisher's exact test, the chi-square test, or Mann-Whitney *U*-test	FELD associated with potential advantages for LLDH, including a rapid recovery, improvement in back pain and disc height preservation
Ahn. et al., 2015 [23]	Retrospective	66 (32/34)	L4/5	Headaches, mild dysaesthesia, post-discectomy pseudocyst	ODI, VAS, SF-12, radiological outcomes	Aged 20-25, L4/5 LDH, failed cons. Rx at least 8 weeks	Student *t*-tests, Mann-Whitney *U* tests, chi-square tests and Fisher's exact tests	Despite the longer and steeper learning curve, still FELD as a good alternative for LDH in young and active adults

nificant improvement in postoperative pain symptoms; (3) Imaging-confirmed residual nucleus pulposus fragments [34]. In this study, an elderly obese woman (BMI: 28.62 kg/m^2) with L5/S1 disc herniation in the FELD group experienced pain and numbness in the left lower limb from the first postoperative day on. In this case, postoperative MRI showed that the residual nucleus pulposus fragments remained on the left side of the L5/S1 intervertebral space, which met the diagnostic criteria for endoscopic surgery failure. On the 13th postoperative day, the second revision surgery was performed using a microscope; consequently, the symptoms of pain and numbness vanished in the left lower limb. In this case, in addition to the factor of obesity [33], disc herniation in the L5/S1 intervertebral space was another important reason behind the endoscopic surgery failure. Although the FELD technique has made great progresses in the treatment of LDH, it is still challenging to perform such a surgery on the L5/S1 intervertebral space, mainly owing to its unique anatomy, i.e., the blocking of the iliac crest, huge facet joints and inclined intervertebral spaces. In some cases, the establishment of a bone tunnel on the iliac crest is required, thus resulting in difficulty increased and failure of the surgery [35]. In this study, there were fewer cases of L5/S1 disc herniation in the FELD group than in the MD group. It is recommended that for those who have L5/S1 disc herniation, the imaging data be fully evaluated pre-operatively, and that FELD surgery be carefully selected.

In this study, due to such shortcomings as the design of the experimental study and the number of samples, it is necessary for us to conduct multi-centre, large-sample, and prospective cohort studies and apply some other effective methods in the future research so that we can further confirm the clinical efficacy of simple nucleotomy for the treatment of single-segment LDH using a microscope and full-endoscope.

Conclusion

In summary, both the MD and FELD can be effective in treating LDH, both having advantages. FELD can be superior when it comes to intraoperative bleeding, incision length, hospital stay, which is especially suitable for the herniated location at the level of disc and suprapedicle; while MD can be slightly better in terms of intraoperative time, intraoperative X-ray fluoroscopy frequency, postoperative recurrence, endoscopic surgery failure and second revision, which is suitable for any location of the herniated disc, especially for the herniated location at the level of infrapedicle and segment of L5/S1.

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Disclosure of conflict of interest

None.

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