

Transforaminal Endoscopic Lumbar Discectomy versus Open Decompression Discectomy for Lumbar Disc Herniation

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ABSTRACT

Objective: To compare the efficacy of transforaminal endoscopic lumbar discectomy (TELD) and open decompression discectomy (ODD) in the treatment of single-segment L4/5 disc herniation.

Study Design: Descriptive study.

Place and Duration of Study: Department of Orthopedics, General Hospital of the Yangtze River Shipping, Jiang'an District, Wuhan, Hubei, China, from January to December 2021.

Methodology: Using random number table allocation, 94 patients with lumbar disc herniation (LDH, at level L4/5) received were divided into two groups of 47 patients each in the control group treated with ODD and 47 patients in the observation group treated with TELD. The perioperative-related indexes, VAS score, ODI index, modified Macnab evaluation criteria, and the incidence of complications were compared between the two groups.

Results: The incision length in the observation group was shorter than that in the control group, the amount of intraoperative blood loss was less than that in the control group, and bedtime and hospital stay were shorter than that in the control group, but the operation time was longer than that in the control group, with statistically significant differences ($p < 0.01$). The VAS score, ODI index, and incidence of postoperative complications in the observation group were lower than those in the control group at 7d, 1 month, 3 months, and 6 months after surgery, while modified Macnab evaluation criteria of lumbar function recovery were higher than that in the control group, the difference was statistically significant ($p < 0.01$).

Conclusion: TELD is safe and effective for patients with LDH, which can relieve postoperative pain and help restore lumbar function.

Key Words: Lumbar disc herniation (LDH), Transforaminal endoscopic lumbar discectomy (TELD), Open decompression discectomy (ODD), Visual analogue score (VAS), Oswestry disability index (ODI), Modified Macnab evaluation criteria.

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INTRODUCTION

LDH is an orthopaedic disease with a high incidence,¹ mainly manifested as lumbago and leg pain, lower limb paresthesia, etc., which will directly affect the daily life and work of patients and reduce their quality of life. Conservative treatment and surgical treatment are the major modes of treatment of the disease.

The outcome of conservative treatment efficacy, usually remarks suboptimal and many patients still need surgery. Open decompression discectomy (ODD) can cause damage to the natural spinal structure resulting in longer postoperative recovery time² and decreased postoperative working ability, so its acceptance is not high among patients.

In recent years, the progress in medical technology and improvement of endoscopic instruments have promoted the development of minimally invasive spinal surgery. Endoscopic surgery can reduce surgical trauma,³ and promote the improvement of surgical effects. The aim of this study was to compare the efficacy of TELD and ODD in the treatment of single-segment L4/5 disc herniation.

METHODOLOGY

Using the random number table method, 94 patients with LDH (L4/5) received by General Hospital of the Yangtze River Ship-

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ping from January to December 2021, were divided into two groups. Forty-seven patients in the control group were treated with ODD and 47 patients in the observation group were treated with TELD.

Inclusion Criteria were diagnosis of LDH (L4/5) based on the patient's medical history, signs and imaging; Unsatisfactory results after systematic conservative treatment for more than 3 months; obvious surgical contraindications, patients and their families had good compliance and were willing to cooperate with treatment and follow visits, and complete follow-up data. Exclusion criteria were patients with spondylolysis, severe lumbar instability, lumbar spondylolisthesis, and tumours in the lumbar spinal canal; multisegmental lesions surgical contraindications; compliance and willing issues to cooperate with treatment and follow-up visits; a history of psychological disorders; and incomplete follow-up data.

ODD was performed under general anaesthesia. After the anaesthesia was satisfied, the patient was taken for the prone position and the abdomen was suspended. After routinely sterilizing and confirming the segments, the incision was cut open and exposed clearly, and one-third of the L4 lamina and two-third of the L5 lamina were removed by lamina rongeur to the medial edge of the articular process, until the ligamentum flavum was exposed. After careful electrocoagulation and hemostasis, attention was paid to protect the dural sac and nerve root. The protruding nucleus pulposus tissue in the spinal canal and the loose nucleus pulposus tissue in the intervertebral space were removed. The incision was closed in turning and covered with an aseptic dressing.

The TESSYS endoscopic spinal surgery system (endoscope, 18G puncture needle, soft tissue dilatation tube, working channel, nucleus pulposus forceps, and blue forceps, etc.), and a disposable radiofrequency plasma operation electrode were used. TLED was performed under local anaesthesia. The patient was taken the prone position and the abdomen was suspended. After routinely sterilizing and confirming the segments. The puncture point was 10-12cm away from the midline on the symptomatic side. The operation was conducted utilising the endoscope. Care was taken to avoid injury to the dura mater, nerve roots, and intervertebral endplates. The ligaments and small joints were preserved as much as possible. And sequestered nucleus pulposus and nucleus pulposus that caused symptoms were removed thoroughly. Simultaneously, thermal annuloplasty was carried out until the dura mater and nerve roots were decompressed completely. The wound was closed with a stitch after complete hemostasis under the microscope.

Peri-operative related indices were incision length, intraoperative blood loss, operation time, bedtime and hospital stay. Visual analogue score (VAS) and Oswestry disability index (ODI) were used for evaluation preoperatively, and 7 days, 1 month, 3 months, and 6 months after the operation. The VAS score ranges from 0 to 10, and the ODI score ranges from 0 to 50. Lower VAS score indicate lighter pain. Lower ODI score means,

milder lumbar dysfunction. Modified Macnab evaluation criteria were applied 6 months after the operation with excellent meaning symptoms completely disappeared and returned to the original work and life. Good meant slight symptoms with mild restriction of activity, no effect on work and life. Fair meant that symptoms were relieved but the activities were limited, affecting normal work and life. Poor meant that there was no difference before and after treatment, or even aggravated. Operation-related complications implied nerve injury, infection, dural rupture, and postoperative dysesthesia (POD) etc.

All data were analysed via SPSS 22.0 software. Measurement data were expressed as the mean \pm standard deviation. Categorical data were compared with the chi-square test. Independent sample t-test was used for intergroup comparisons. A value of $p < 0.05$ was considered statistically significant, and $p < 0.01$ was deemed highly significant.

RESULTS

There were 30 males (63.83%) and 17 females (36.17%) in the control group; and 28 males (59.57%) and 19 females (40.43%) in the observation group. The average age was 50.15 ± 2.60 years in the control group and 50.23 ± 2.67 years in the observation group. There were 20 cases of central disc herniation and 27 cases of para-central herniation in the control group; with 18 cases of central and 29 cases of para-central herniation in the study group ($p > 0.05$).

The incision length was 0.67 ± 0.04 cm in observation group, which was shorter than that in control group (1.86 ± 0.60 cm). The amount of intraoperative blood loss was 25.08 ± 9.25 ml in observation group, which was less than that in control group (50.63 ± 13.34 ml). Bedtime and hospital stay were 1.40 ± 0.20 days and 7.54 ± 1.58 days in observation group, which were shorter than that in control group (4.35 ± 1.16 days and 12.42 ± 3.42 days). The operation time was 92.51 ± 9.26 minutes in the observation group, which was longer than that in the control group (66.58 ± 6.41 minutes). There were statistically significant differences in all perioperative related indices ($p < 0.01$).

The VAS score, ODI index and the frequency of postoperative complications in the observation group were lower than those in the control group at 7d, 1 month, 3 months, and 6 months after surgery ($p < 0.01$, Table I). Modified Macnab evaluation criteria of lumbar function recovery was higher than that in the control group, with statistically significant differences ($p < 0.01$, Table II).

There was one case of nerve root injury in the control group and none in the observation group; 4 cases of muscle weakness in the control group and one case in the observation group, 3 cases of uroschesis in the control group and 1 case in the observation group. Operation-related complications were lower in the observation group than that in the control group, with statistically significant differences ($p < 0.05$).

Table I: VAS And ODI.

	VAS					ODI				
	Preoperative	Postoperative 7 days	Postoperative 1 month	Postoperative 3 months	Postoperative 6 months	Preoperative	Postoperative 7 days	Postoperative 1 month	Postoperative 3 months	Postoperative 6 months
Control Group	7.40±1.35	4.64±1.82	3.85±1.71	3.16±1.24	2.11±0.95	38.24±6.61	27.62±6.20	21.37±4.55	17.45±3.02	12.56±2.38
Observation Group	7.43±1.41	3.25±1.19	2.58±1.06	2.08±0.82	1.20±0.46	38.30±6.64	22.50±4.16	16.45±3.28	13.20±2.37	8.14±2.06
t	0.105	4.382	4.328	4.981	5.911	0.044	4.701	6.014	7.590	9.627
p	0.916	0	0	0	0	0.965	0	0	0	0

Table II: Macnab.

	Excellent	Good	Fair	Poor
Control group	17	20	7	3
Observation group	27	18	2	0
X ²	6.114			
P	0.013			

DISCUSSION

The pathogenesis of LDH lies in the degeneration of the intervertebral disc, which causes the rupture of annulus fibrosus, protrusion of the nucleus pulposus, compression, and stimulation to nerve root, aseptic inflammation and oedema of nerve root, and leads to the occurrence of a series of symptoms such as low back pain and so on. Therefore, the main goal of the treatment for LDH is to relieve compression and relieve nerve stimulation symptoms.

In recent years, the development of endoscopic technology has greatly improved the management of LDH. ODD, as a traditional operation, has the characteristics of simple operation and clear vision.^{4,5}

It can fully release the compression and decompression of the nerve root canal, better protect the spinal structure, reduce the impact on spinal stability,^{6,7} and effectively relieve pain symptoms. However, this operation requires pulling the nerve root and dura mater to expose protrusions, which will increase the risk of nerve root injury and postoperative adhesion and affect the prognosis.⁸ TELD is a perfect combination of percutaneous puncture and endoscopy,⁹ which can reduce trauma, remove nucleus pulposus directly and perform decompression via transforaminal approach, as well as completely release the compressed nerve root with foraminoplasty and annulus fibroplasty,¹⁰⁻¹³ and better relieve the symptoms of low back pain. In addition, TELD, without or with only a small amount of bone removed, can reduce the damage to paraspinal tissues and muscles,¹⁴ reduce the amount of blood loss, postoperative adhesion and scar formation, and preserve the integrity and stability of the spine.^{15,16} TELD can effectively repair the ruptured annulus fibrosus and remove the disc fragments through physiological saline irrigation, which can reduce the recurrence rate of intervertebral space infection.¹⁷

This study data showed that the perioperative related indices in the observation group were significantly better, postoperative VAS and ODI were decreased significantly, and the excellent and good rate of lumbar functional recovery was higher,

with fewer complications, which were similar to the recent studies.⁵⁻⁷ It proved that the curative effect of TELD was more significant than that of laminae fenestration. The reason was that TELD can effectively relieve nerve root compression while removing the herniated intervertebral disc. Microscopic operation can avoid the injury of nerve root, reduce local nerve inflammation, alleviate postoperative pain symptoms and accelerate the recovery of lumbar function, so it can shorten the patient's bedtime and hospital stay.

CONCLUSION

TELD, with high effectiveness and safety, which can significantly alleviate pain symptoms and improve lumbar function, is suitable for promotion and application in the treatment of LDH.

ETHICAL APPROVAL:

This research was approved by the General Hospital of the Yangtze River Shipping Ethics Committee (Wuhan, China; permit No. L20200015) and was in conformity with the guidelines of the National Institute of Health.

PATIENT'S CONSENT:

Written informed consents were formally obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

COMPETING INTERESTS:

The authors declared no competing interests.

AUTHORS' CONTRIBUTION:

JXH, JT: Made substantial contributions to the study conception and design, the acquisition of data and the analysis and interpretation of data.

PW, XFX: Contributed to drafting the manuscript and critically revising the manuscript for important intellectual content.

JXH, JT: Prepared the manuscript.

All the authors have approved the final version of the manuscript to be published.

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