Research Paper

Analysis of Influencing Factors on Short-Term Efficacy of Percutaneous Transforaminal Endoscopic Lumbar Discectomy in the Treatment of Lumbar Disc Herniation

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To explore the factors influencing the short-term efficacy of percutaneous transforaminal endoscopic lumbar discectomy in the treatment of lumbar disc herniation is the main objective. 100 patients with lumbar disc herniation who were treated in our hospital from February 2017 to February 2019 were selected as the control group (n=85, effective) and observation group (n=15, ineffective), the effective rate of treatment was statistically analyzed. Visual analogue scale and Japanese orthopaedic association scores were compared before surgery, 3 mo after surgery and 6 mo after surgery. The influencing factors of lumbar disc herniation treatment effect were analyzed. The effective rate of lumbar disc herniation patients treated by percutaneous transforaminal endoscopic lumbar discectomy surgery was 85.00 %. Compared with that before surgery, the visual analogue scale score of lumbar disc herniation patients was significantly decreased 3 mo after surgery and 6 mo after surgery, but the Japanese orthopaedic association score was significantly increased ($p<0.05$). In logistics regression analysis, it was found that the course of disease, history of trauma and degree of lumbago were the main factors affecting the therapeutic efficacy of percutaneous transforaminal endoscopic surgery in patients with lumbar disc herniation. There are many factors influencing the efficacy of percutaneous transforaminal endoscopic surgery for lumbar disc herniation patients and the relationship between them and the therapeutic effect should be comprehensively analyzed.

Key words: Percutaneous transforaminal endoscopic lumbar discectomy, lumbar disc herniation, short-term efficacy, visual analogue scale score, Japanese orthopaedic association score

Lumbar disc herniation (LDH) is a common disease in spine surgery. It is the most common cause of lower back and lower leg pain and it mainly occurs in middle-aged and old people[1]. The clinical manifestations of LDH include lumbago and sciatica, as well as pain, numbness and weakness of lower limbs[2]. Treatment for LDH can be performed surgically and non-surgically, but after 3 mo of non-surgical treatment, the patient remains unresponsive and should be treated surgically. According to foreign studies[3], in the past, many surgical methods such as posterior discectomy and interbody fusion and internal fixation were used for the treatment of LDH. However, after clinical study, it was found that this surgery caused greater trauma to the patient and more damage to the patient's posterior column structure. In recent years, with the development of medical technology, percutaneous transforaminal endoscopic lumbar discectomy has achieved good results in the treatment of LDH and has the advantages of small trauma and ability to preserve the stability of patients lumbar posterior column structures[4]. It has been widely used in clinical practice. Although there are many advantages of the percutaneous transforaminal endoscopic lumbar discectomy approach compared with the conventional approach, the clinical results show that some patients are still far less effective after surgery than expected[5]. Therefore, the research focus is to explore the related factors that affect the efficacy of percutaneous transforaminal endoscopic lumbar discectomy in the treatment of LDH. This paper will

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explore the factors that affect the short-term efficacy of percutaneous transforaminal endoscopic lumbar discectomy in the treatment of LDH, in order to provide reference suggestions for clinical practice, which are reported as follows.

MATERIALS AND METHODS

General data:

From February 2017 to February 2019, 100 LDH patients, 50 males and 50 females, aged 38-70 y, with a course of disease of 1-20 y, were selected and divided into observation group and control group according to the curative effect. All patients and their families were informed about the study and had signed the informed consent form.

Inclusion criteria and exclusion criteria:

Inclusion criteria-Complete clinical data; ineffective non-surgical treatment for more than 3 mo; successful percutaneous transforaminal endoscopic surgery; meeting diagnostic criteria for LDH; no previous surgical treatment. Exclusion criteria-Patients with severe autoimmune diseases; patients with intervertebral disc protrusion calcification; patients with lumbar spine instability or spondylolisthesis; patients with spinal tumor, infection or tuberculosis; patients with confusion who cannot cooperate with treatment.

Treatment methods:

The patient was placed in the prone position and the skin puncture point was first determined. Puncture points of $L_{4\sim5}$, $L_5\sim S_1$ and $L_{3\sim4}$ were located 12-14 cm and 8-10 cm next to the midline of the spinous process, respectively. The patient was given local anesthesia with 1 % lidocaine (Hebei Jiupai Pharmaceutical Co., Ltd., H20063371) after routine disinfection. Under the fluoroscopy of C-arm X-ray machine, insert the cervical intervertebral foramen into the intervertebral disc and inject 2 ml mixed solution of iodine contrast medium and methylene blue. The skin was then cut approximately 0.7 cm along the guide and placed through the guide wire into the dilating tube prior to placement in the working tube. Connect the endoscope system, observe the field of view of operation and clean the surrounding tissues. The position of nucleus pulposus was clearly highlighted and the stained blue denatured nucleus pulposus tissue was removed with a mini-nucleus pulposus forceps and the residual nucleus pulposus debris was carefully cleaned until the dural sac and nerve root was completely decompressed and the surgical field was repeatedly rinsed with sterile normal saline. The wound was closed after removal of the device. The procedure was completed.

Therapeutic response assessment:

Excellent-The patient's clinical symptoms are disappeared, with no effect on the patient's work and life. Good-The patient's symptoms are significantly improved or only mild limitation of activities. General-The patient's symptoms have improved, it has limited some of the patient's activities and has an impact on the patient's life and work. Poor-The patient's symptoms do not improve or is worsened and it has an impact on the patient's life and work. Of these, excellent and good are considered effective, while general and poor are considered ineffective.

Observation indicators:

Clinical efficacy-Evaluate the clinical efficacy of patients and group them according to their therapeutic efficacy. The patients who responded to treatment were used as the control group and the patients who failed to respond to treatment were used as the observation group. Visual analogue scale (VAS) and Japanese Orthopaedic Association (JOA) scores-Patients VAS and JOA were scored before surgery and 3 and 6 mo after surgery, respectively. Analysis of influencing factors-Taking the treatment effect of the patient as independent variable, single factor analysis was performed on the age, gender, course of disease, clinical manifestation, surgery segment, fibrous ring rupture or not, working mode and intervertebral disc degeneration grade of the patient and multi-factor logistics regression analysis was performed on the patients with significant difference in single factor analysis.

Statistical processing:

Statistical package for the social sciences (SPSS) 22.0 statistical software was used to analyze the data. Where, the measurement data conforming to normal distribution are expressed as mean±standard deviation (SD) ($\bar{x}\pm s$) and t-test is used for inter-group comparison; case number (n) or percentage (%) is used for enumeration data and χ^2 test is used for data comparison. Logistics regression analysis was used for multi-factor analysis and the difference was statistically significant when $p<0.05$.

RESULTS AND DISCUSSION

Patient treatment effective rate was shown in Table 1. After percutaneous transforaminal endoscopic lumbar discectomy treatment, the effective rate of LDH patients was 85.00 %.

VAS score and JOA score of patients before and after treatment was measured. Compared with that before operation, the VAS score of patients 3 mo and 6 mo after surgery were significantly lower, while the JOA score of patients in 3 mo and 6 mo after surgery were significantly higher than that before surgery and the differences had statistical significance ($p<0.05$); however, there was no significant difference between 6 mo after surgery and 3 mo after surgery and there was no statistical significance ($p>0.05$) (Table 2).

Single factor analysis affecting LDH was shown. The results of single factor χ^2 test showed that the age, course of disease, Pfirrmann's classification of intervertebral disc and history of trauma of the patients in the observation group were higher than that in the control group and the degree of lumbago was significantly higher than that in the control group and the differences had statistical significance ($p<0.05$); while the gender, course of disease, working mode, pain manifestation, Modic change, surgery segment, fiber ring rupture and Lee partition of the patients in the observation group were not significantly different from those in the control group and there was no statistical significance ($p>0.05$) (Table 3).

Multi-factor logistics regression analysis affecting LDH efficacy is shown here. Logistics regression analysis showed that course of disease, history of trauma and degree of lumbago were correlated with the curative effect of LDH patients ($p<0.05$), while age and Pfirrmann's classification of intervertebral disc were not correlated with the curative effect of patients ($p>0.05$) (Table 4).

TABLE 1: PATIENT TREATMENT EFFECTIVE RATE [n (%)]

Category	Number of cases (n=100)
Excellent	38 (38.00)
Good	47 (47.00)
General	10 (10.00)
Poor	5 (5.00)
Effective rate	85 (85.00)

TABLE 2: VAS SCORES AND JOA SCORES OF PATIENTS BEFORE AND AFTER TREATMENT

Observation items	Before surgery	3 mo after surgery	6 mo after surgery
VAS score	8.64±1.42	0.95±0.43*	0.46±0.12*
JOA score	9.75±2.00	24.26±2.46*	25.31±3.16*

Note: *indicates compared with that before surgery, $p<0.05$

TABLE 3: SINGLE FACTOR ANALYSIS OF LDH ($\bar{x}$±s, CASE)

Dependent variable		Observation group (n=85)	Control group (n=15)	χ^2 value	p value
Gender	Male	45	8	2.597	1.234
	Female	40	7		
Age	<45 y old	61	5	1.659	0.003
	≥45 y old	24	10		
Course of disease	<6 mo	40	1	1.264	0.002
	6-12 mo	35	4		
	>12 mo	10	10		
Working mode	Free and easy type	45	8	0.264	0.264
	Weight bearing type or sedentary type	40	7		
Pain manifestation	Leg pain mainly	40	2	0.349	0.003
	Lumbago mainly	40	3		
	Lumbago and leg pain	5	10		

Pfirrmann's classification of intervertebral disc	Class II	5	1	1.0345	0.003
	Class III	50	4		
	Class IV	30	10		
Modic change	Yes	40	8	2.597	0.235
	No	45	7		
Surgery segment	L_{2-3}	4	1	1.264	0.348
	L_{3-4}	6	1		
	L_{4-5}	55	9		
	L_5~S_1	20	4		
History of trauma	Yes	10	12	0.348	0.026
	No	75	3		
Fiber ring rupture	Yes	60	9	2.015	1.264
	No	25	6		
Lee partitioning	Zone 2	25	3	1.264	1.897
	Zone 3	50	10		
	Zone 4	10	2		

TABLE 4: MULTI-FACTOR LOGISTICS REGRESSION ANALYSIS AFFECTING LDH EFFICACY

Index	Coefficient value (b)	Coefficient standard error (SE)	Odds ratio (OR)	OR 95 % confidence interval (CI)	Wald (χ^2)	p
Age	1.0678	0.6945	2.9048	0.7458~11.3562	2.3602	1.2678
Course of disease	1.3756	0.4356	3.9758	1.7006~9.2885	10.1564	0.006
Pfirrmann's classification of intervertebral discc	1.1135	0.7148	3.0495	0.7564~12.2658	2.4523	0.235
History of trauma	1.1126	0.2659	3.4512	1.4561~5.6482	6.2648	0.002
Degree of lumbago	1.1685	0.4002	3.2169	1.4662~7.0556	8.5026	0.005

LDH is one of the most common degenerative diseases of spine and it is also the most common disease that causes lumbago and leg pain[6]. For the treatment of LDH, in the past, the main clinical methods were push-plate fenestration and compression nucleus pulposus extraction, push-plate fenestration nucleus pulposus removal and *so on*. In recent years, with the development of science and technology and the widespread application of minimally invasive endoscopic techniques, percutaneous transforaminal endoscopic surgery has achieved good results in the treatment of LDH. According to the clinical study, the effective rate of treatment is about 80 %, which far exceeds that of previous treatment methods. After percutaneous transforaminal endoscopic lumbar discectomy treatment, the recovery time of patients is short due to their small trauma[7]. After surgery, the adhesion of nerve root and dural sac is the result of the combination of local injury, hematoma formation and inflammatory reaction. The adhesion of nerve root may limit the movement of spinal cord and nerve root, generate the corresponding local change and finally cause the residual or recurrent phenomenon of patient's symptoms[8]. While the transforaminal endoscopic surgical system (TESSYS) technique in the percutaneous transforaminal endoscopic lumbar discectomy addresses this problem, the TESSYS technique is based on refinement of a special spiral burr, grinding along the nerve root and removal of the ventral nucleus pulposus of the nerve root, hypertrophic calcified tissue, ligamentum flavum of the dorsal aspect, scar tissue, etc., to achieve complete never root release[9,10].

The percutaneous transforaminal endoscopic lumbar discectomy technique is becoming a state of the art technique and therefore has a higher requirement for those performing surgery, including having a good basis for open surgery, being familiar with local anatomy and being adept at hand-eye separation[11]. Although the percutaneous transforaminal endoscopic lumbar discectomy technique has been shown to be effective in the treatment of LDH, it has been used clinically for relatively short periods of time and there

are few relevant studies on the influencing factors of this technique in the treatment of patients with LDH[12]. In the above study, the effective rate of percutaneous transforaminal endoscopic surgery in patients with LDH was 85.00 %. After percutaneous transforaminal endoscopic therapy, the pain scores of patients were significantly improved, indicating that the percutaneous transforaminal endoscopic therapy had less trauma to patients, which was consistent with the study by Huang *et al.*[13]. The results of single factor analysis showed that the age, course of disease, Pfirrmann's classification of intervertebral disc, history of trauma and the degree of lumbago were closely related to the curative effect of LDH, but after the multi-factor logistics analysis, the course of disease, history of trauma and the degree of lumbago were correlated with the curative effect of LDH, while the age and Pfirrmann's classification of intervertebral disc were not correlated with the curative effect of LDH. This is similar to the results of Yilmaz *et al.*[14].

It is analyzed that, for patients with a relatively long course of disease, the nerve damage of patients will be aggravated gradually, especially the long-term mechanical compression, immune reaction and inflammatory stimulation, which will make the nerve root in a high tension state. The long-term duration of this state will cause irreversible nerve injury, thus having an effect on the therapeutic efficacy of patients. The prominent symptoms of LDH mainly include leg pain, lumbago, as well as both lumbago and leg pain. Under normal conditions, leg pain is mainly associated with neuromechanical compression and lumbago is associated with neuroimmune response and inflammatory response. While the percutaneous transforaminal endoscopic lumbar discectomy technique alleviates neuromechanical compression, it has no significant effect in the treatment of neuroimmune and inflammatory responses and is therefore less effective in patients with low back pain. At the same time, for the patients with history of trauma, the intervertebral degeneration is obvious, most of them have local pathological changes such as lumbar spinal canal stenosis, intervertebral joint hyperplasia and nerve root adhesion, which will increase the difficulty of operation. In the above study, although the multi-factor regression analysis showed that age and Pfirrmann's classification of intervertebral disc were independent factors, it also had certain influence on the curative effect, among them, the age increased, the water content of nucleus pulposus, the elasticity of intervertebral disc and the anti-load ability decreased gradually, at the same time, the elderly patients had poor physical fitness and their organ function and osteoporosis were poor, which brought some difficulties to the surgery, while the Pfirrmann's classification of disc degeneration reflects the degree of disc degeneration, the greater the grade, the greater the degree of disc degeneration and the worse the effect of LDH. This is similar to the results of the study by Haijie *et al.*[15].

In summary, factors affecting the short-term efficacy of LDH include the patient's course of disease, degree of lumbago and history of trauma. Care should be taken to stop bleeding during percutaneous transforaminal endoscopic lumbar discectomy surgery to avoid excessive bleeding that may affect the surgical field; attention should be paid to effective root release to avoid loss of tissues such as blood vessels, nerve roots and dura mater.

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Conflicts of interest:

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