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The posterior approach operation to treat thoracolumbar disc herniation

A minimal 2-year follow-up study

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Abstract

Thoracolumbar disc herniation (TLDH) is a rare and progressively disabling disorder; surgical procedures predispose the subjects to high incidence of complications including recurrence, neurological aggravation, and adjacent segment degeneration.

Ten patients with TLDH underwent posterior approach operation in our institution from January, 2006 to December, 2015. The mean preoperative duration of clinical symptoms was 16.5 months. The clinical data including operative time, blood loss, and hospitalization duration were investigated. Furthermore, pre and postoperative neurological status was evaluated by the modified Japanese Orthopedic Association (JOA) scoring system and pain by visual analog scale (VAS) scoring system.

The mean operative time was 176.50 ± 20.55 minutes, the mean blood loss was 435.00 ± 89.58 mL, and the mean hospitalization length was 13.30 ± 2.97 days. All patients were followed with a mean period of 35.1 months. The mean JOA score of all patients before operation, at discharge, 3 months after operation, and at last follow-up was 6.50 ± 1.28, 7.60 ± 1.22, 8.90 ± 0.99, and 9.00 ± 0.92, respectively. The differences between the pre and postoperative JOA and VAS scores were significant ($P < .05$). However, the differences of JOA and VAS scores at postoperative 3 months and final follow-up were not statistically significant.

Posterior approach operation is an ideal surgical technique for treatment of TLDH; the operative time, blood loss, hospitalization duration, and symptomatic improvement are favorable.

Abbreviations: JOA = Japanese Orthopedic Association, TLDH = Thoracolumbar disc herniation, VAS = visual analog scale.

Keywords: posterior approach, thoracolumbar disc herniation, TLDH

1. Introduction

Thoracolumbar disc herniation (TLDH) is a rare disorder referring to the symptomatic disc herniation occurring from T10/11 to L1/2 levels. It constitute about 0.25% to 5% of all lumbar degeneration diseases.[1] It may cause various symptoms attributable to the polytropic neuromechanism in different levels. Posterior decompressive laminectomy was the most common operation of TLDH about 10 years ago. In recent years, anterolateral retroperitoneal, anterior transthoracic, posterolateral, and lateral approaches are performed in discectomy with or without fusion and internal fixation. However, patients who have undergone any operation at these levels are predisposed to postoperative recurrence, neurological aggravation, and adjacent segment degeneration, and the outcomes are inferior than those in lower lumbar spine.[2,3] In general, we usually perform decompressive operations for our patients via posterolateral approach. This approach is customary in our department with low risk of nerve injury.

2. Materials and methods

2.1. Patients

From January, 2006 to December, 2015, 10 patients with thoracolumbar disc herniation underwent posterolateral approach operation in our institution including 8 males and 2 females, and the average age was 51.9 years (range from 34 to 62 years). Physical examination revealed myelopathy in 2 patients, radiculopathy in 3, and both in 5. The mean preoperative duration of clinical symptoms was 16.5 months (range from 1 to 36 months). The main preoperative symptoms included lower-extremity weakness in 7 patients (Table 1), lower-extremity numbness in 8 patients, lower-extremity pain in 2 patients, drop foot in 3 patients, and bowel or bladder dysfunction in 3 patients. All of these patients complained of low back pain with or without myelopathy or radiculopathy. Four patients had presence of Babinski sign, of which 3 was unilateral and 1 was bilateral. Five patients had a positive Lasegue sign (3 unilateral and 2 bilateral). Electromyographic study is not routine in our department. There were only 2 patients with foot drop had underwent electromyographic studies, and 2 studies demonstrated damage of peroneal

Editor: Song Liu.

Author contributions: Conceived and designed the experiments: XY; analyzed the data: JK and ZQC; wrote the paper: JK; carried out literature search: WH; revised and improved manuscript: XY. All authors have read and approved the final submitted manuscript.

The authors report no conflicts of interest.

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Medicine (2018) 97:16(e0458)

Received: 10 June 2017 / Received in final form: 11 March 2018 / Accepted: 22 March 2018

http://dx.doi.org/10.1097/MD.0000000000010458

Table 1

Demographic data and clinical presentation of 10 patients with TLDH.

Indices	Values
Number of patients	10
Sex	
Male	8
Female	2
Mean age ± SD, y	51.9 ± 8.4
Symptoms and signs	
Back pain	10
Lower-extremity pain	2
Lower-extremity weakness (foot drop)	7 (2)
Lower-extremity numbness	8
Bowel or bladder dysfunction	3
Babinski sign (unilateral and bilateral)	5 (3 and 2)
Operative level	
T10/11	0
T11/12	7
T12/L1	2
L1/2	1

TLDH = thoracolumbar disc herniation.

nerves. One patient had undergone chemonucleolysis in other hospital, with symptoms exacerbated after primary operation. All of these patients were followed for a minimal duration of 13 months (range from 13 to 52 months, mean 35.1 months). A retrospective study was performed to review the surgical methods, operative time, blood loss, length of postoperative hospital stay, perioperative complications, and surgical outcomes (Table 2).

2.2. Operative intervention

2.2.1. Preoperative preparation. All patients experienced physical examination, and the imaging examination including the x-ray, computed tomography, and magnetic resonance imaging; by the means of these methods, we identified the lesions responsible for clinical manifestations. All patients have undergone blood routine, hepatorenal function, and coagulation function examination before the operation to ensure the safety of operation.

2.2.2. Operative procedure. The posterior elements were exposed through the midline incision in prone position. The pedicle screw-rod system was implanted at the segments of decompression, and laminectomy was performed in all patients. In 7 patients of 10, who had severe spinal occupancy, the entire inferior articular process and the superior portion of the superior articular process were removed to gain sufficient exposure of the lesion. After identification of the nerve root and dural sac, discectomy was performed under the protection of the nerve root and dural sac. The autogenous bone retrieved from the extirpated laminae and facet joints was crunched and grafted into the intervertebral space. Three patients did not receive discectomy taking into account of their mild compression that was sufficiently decompressed by laminectomy. Intertransverse process fusion with autologous bone grafting was performed on all the patients. Throughout the whole process of operation, electric coagulation hemostasis was necessary to provide a clear surgical field (Fig. 1).

2.2.3. Postoperative care. Neurotrophic medication (eg, monosialotertrahexosylganglioside) was used intravenously after operation. The drainage tube was removed within 48 hours postoperatively. Patients were allowed to ambulate at the forth postoperative day with rigid waist orthoses. Patients were taught with physical training of waist and lower-extremity muscle before the operation, and we considered it should be carried out from the first postoperative day. Dressing change was performed every 3 days.

2.3. Clinical outcomes and radiologic evaluation

The operative time and intraoperative blood loss were recorded. All patients underwent anteroposterior and lateral plain radiographs of operated segments within 7 days after operation. They were followed through telephone interview by an experienced spine surgeon. Back and lower-extremity pain was assessed by visual analog scale (VAS) scores pre and postoperatively. The pre and postoperative neurologic status was assessed by the modified Japanese Orthopedic Association (JOA) scoring system of 11 points (Table 3).

2.4. Statistical analysis

The Wilcoxon signed-rank test was used for the pre and postoperative comparison of back and lower-extremity pain VAS scores. The paired-sample *t* test was used for the pre and postoperative comparison of pre and postoperative neurologic statuses JOA scores. We used SPSS 13.0(SPSS Inc., Chicago, IL) software to analyze data, and *P* value less than .05 was considered as significant.

2.5. Ethical statement

This study was approved by the Medical Ethics Committee of General Hospital, Jinan Command of the People's Liberation Army. Written informed consent was obtained from the patients

Table 2

The detail of lower-extremity weakness.

	Grade of muscle strength (grade 0 to grade 5)											
	Iliopsoas		Quadriceps femoris		Biceps femoris		Tibialis anterior muscle		Peroneus muscle		Extensor hallucis longus	
No. of patients	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
1	5	5	5	5	5	5	4	0	4	3	4	0
2	5	5	5	4	5	4	5	4	5	3	5	3
3	5	5	4	5	4	5	5	5	5	5	5	5
4	5	5	5	5	5	5	1	5	3	5	0	5
5	5	5	4	5	4	5	4	5	4	5	4	5
6	4	5	5	5	5	5	5	5	5	5	5	5
7	5	5	5	5	5	5	1	1	1	1	1	1

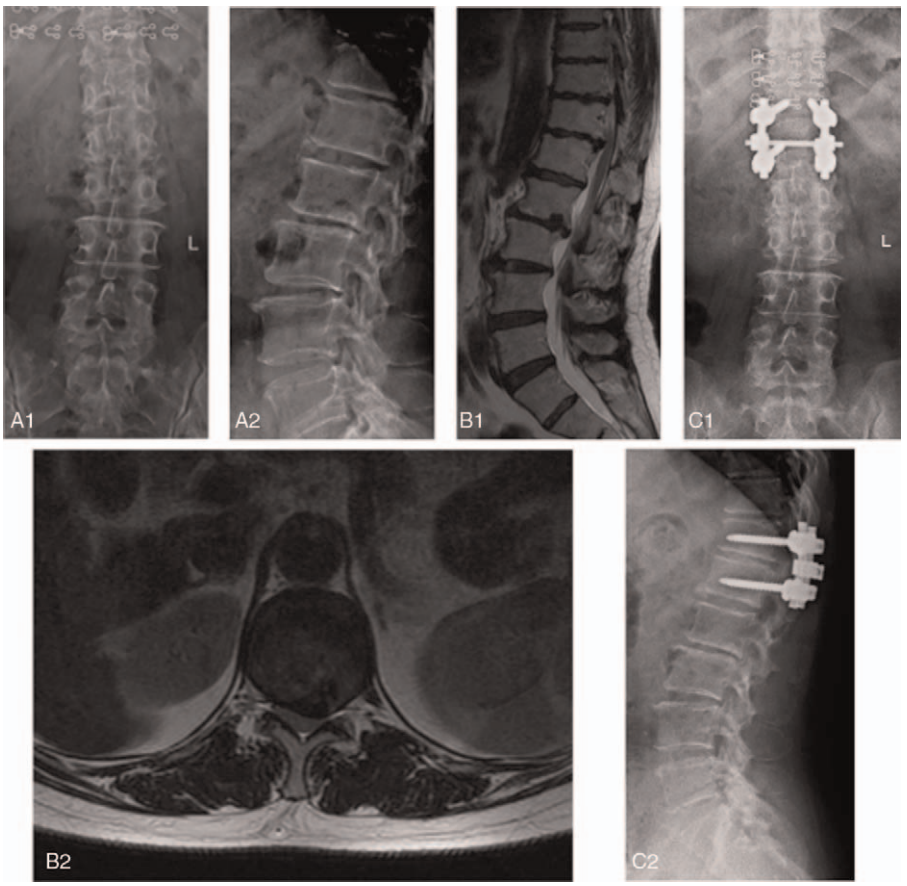

Figure 1. Illustrative patient. A 58-year-old female patient with T12-L1 disc herniation. Preoperative x-ray and MRI demonstrated spinal degeneration and compression at T12-L1 level (A, B); postoperative plain radiographs (C). MRI = magnetic resonance imaging.

Table 3

Modified Japanese Orthopedic Association (JOA) scoring system (full score = 11).

Function score	Description
Motor	
Lower extremity	
0	Unable to stand up or walk by any means
0.5	Able to stand up but unable to walk
1	Unable to walk without a cane or other support on a level surface
1.5	Able to walk without a support but with a clumsy gait
2	Walks independently on a level surface but needs support on stairs
2.5	Walks independently when going upstairs, but needs support when going downstairs
3	Capable of fast but clumsy walking
4	Normal
Sensory	
Trunk	
0	Complete loss of touch and pain sensation
0.5	50% of normal sensation or below and/or severe pain or numbness
1	Over 60% of normal sensation and/or moderate pain or numbness
1.5	Subject numbness of a slight degree without any objective deficit
2	Normal
Lower extremity	
0	Complete loss of touch and pain sensation
0.5	50% of normal sensation or below and/or severe pain or numbness
1	Over 60% of normal sensation and/or moderate pain or numbness
1.5	Subject numbness of a slight degree without any objective deficit
2	Normal
Bladder function	
0	Urinary retention and/or incontinence
1	Sense of retention and/or dribbling and/or thin stream and/or incomplete continence
2	Urinary retardation and/or pollakiuria
3	Normal

or patients' family for publication of this study and accompanying images.

3. Results

3.1. Operative time, blood loss, perioperative complications, and postoperative hospital stay

The mean operative time was 176.50 ± 20.55 minutes (range from 142 to 211 minutes). The mean blood loss was 435.00 ± 89.58 mL (range from 300 to 600 mL). There were no major complications of all these cases. The mean postoperative time of hospitalization was 13.30 ± 2.97 days (range from 8 to 19 days). All stitches of wounds were taken out in hospitalization.

3.2. Neurological status

The mean JOA score of all patients before operation, at discharge, 3 months after operation, and last follow-up was 6.50 ± 1.28, 7.60 ± 1.22, 8.90 ± 0.99, and 9.00 ± 0.92, respectively. The difference between the pre and postoperative JOA scores was significant. However, the difference between JOA scores at postoperative 3 months and final follow-up was not statistically significant ($P < .05$) (Fig. 2). The outcomes indicated that the neurological status gained an obvious improvement during hospitalization, major improvement at 3 to 6 months after operation, and no significant difference after the first postoperative year.

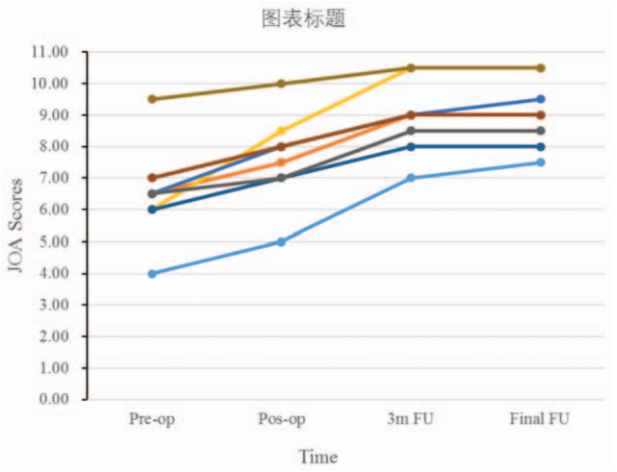

Figure 2. JOA scores (full score = 11). JOA = Japanese Orthopedic Association.

3.3. Back and lower-extremity pain

The mean VAS scores of back pain before operation, shortly after operation, and at final follow-up were 4.70 ± 2.37, 0.80 ± 0.75, and 0.20 ± 0.40, respectively. All these patients felt back pain improvement, and the lower-extremity pain in 2 patients were relieved shortly after operation. The difference between them were statistically significant ($P < .05$) (Fig. 3). At the final follow-up, the back and lower-extremity pain had no significant difference between the final follow-up and 3 months after operation (the pain of incision was differentiated from the back pain).

4. Discussion

Thoracolumbar spine involves the region from T10 to L2 levels. As transition segments of thoracic and lumbar vertebrae, they endure more extension-flexion movement and sagittal shear stress than other parts of the spine. Because the levels are associated with the transition region from spinal cord to conus medullaris, it contains the lumbar spinal cord, conus medullaris, cauda equine, and nerve root. The Clinical symptoms resulting from TLDH are various owing to the complicated and diversified neural structure at this level. Back pain is the most common clinical sign of TLDH patients. In the current study, 9 patients complained of back pain as the initial symptom. On examination, hypopselaphesia (sensory diminution of skin) was found below the groin level in 5 patients and anterolateral thigh in 2 patients. Three patients presented with hypesthesial in the unilateral or bilateral dorsum of foot. Only 2 patients complained of lower-extremity pain. Two patients had hypermyotonia (dystonia, muscular tension increased) of the lower limbs. The myodynamia (muscle strength, classified from grade 0 to grade 5) decreased to varying degrees in 8 patients measured by the manual muscle strength test. All these findings indicated that the clinical symptoms were heterogeneous in TLDH patients.[4] Therefore, the lesions responsible for the symptoms are difficult to be identified according to the examination.[4,5] In the current series, we identified the responsible segments through integrated evaluation of imaging and physical examination. It is well -recognized that the early clinical symptoms of TLDH are usually atypical, and aggravate more quickly than lumbar disc herniation, because the epidural fat (which is crucial for buffering the compression on the dura meter) in the thoracolumbar fraction is limited.[4,6,7]

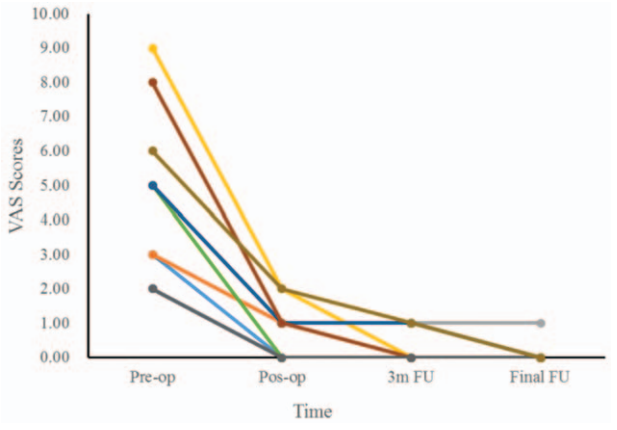

Figure 3. VAS scores. VAS = visual analog scale.

The treatment of TLDH includes conservative and surgical approaches. For cases with severe compression the cord and nerve root complicated with symptomatic exacerbation, surgical treatment is undoubtedly 1 of the optimal treatment for TLDH. Chen[8] considers that the surgical indications of TLDH include: no improvement after the conservative treatment for 3 months; rapidly progressive symptoms; myodynamia decreasing accompanied by muscle atrophy; sphincter disability; a definitely severe compression of neuromechanism according to imageological examination with mild symptoms. Previous literature and the present findings demonstrated that TLDH is usually located at central or central-lateral part of the ventral dural sac.[9,10] As a result of thoracolumbar biomechanical characteristics, many TLDH are accompanied by calcification of the annulus fibrosus or posterior longitudinal ligament. The bridging of the osteotomy is usually found in the degenerative segments.[11] These factors increase the difficulty in exposure and excision of the thoracolumbar intervertebral disc than in the lumbar spine via posterior approach. Controversy continues about the optimal surgical approach for TLDH. Early reports in the literature described laminectomy and discectomy via posterior midline approach as the treatment for TLDH. Due to the unavoidable traction of dural sac, the incidence of iatrogenic injury of the spinal cord and nerve roots was notable. Love and Kiefer[12] reported the surgical treatment of 17 cases with TLDH using the posterior midline approach operation; of these subjects, 7 patients suffered from aggravated symptoms and 10 had no improvement. Arce and Dohrmann[13] reported 129 cases undergoing the similar surgical procedures; symptoms of 28% patients deteriorated, 11% patients gained invalid operation, and 4% patients died. We all consider that this approach is not appropriate for TLDH. In 1958, Grafood et al[14] firstly described the operation via anterior approach through the thorax for the thoracic disc degeneration. The anterior approach could provide direct decompression and help prevent the spinal cord injury.[15] Literature claimed the anterior approach through the thorax or retroperitoneum is the surgical protocol of choice for thoracolumbar disc herniation. However, perioperative complications including pneumonia, infection, and injury of pleura and peritoneum are frequent. With the advances of the pedicle screw-rod system and surgical techniques, the posterolateral approach is gaining popularity for treatment of TLDH; its advantages include satisfying decompression and limited irritation of the neurological structures. Ebrahimzadeh et al[16] reported favorable outcomes in 3 TLDH cases undergoing operation via posterolateral approach. Yamasaki et al[17] performed discectomy via posterolateral approach on 11 patients with thoracic

disc herniation and obtained satisfactory therapeutic efficacy of the treatment. Posterolateral approach have some advantages compared to other approach: sufficient excision of lamina, ligamenta flava, and articular processes to achieve effective posterior decompression; excision of thoracolumbar disc without over retractor of nerve root and dural sac to reduce the nerve injury; sufficient intervertebral bone grafting and internal fixation to obtain stability of spine; smaller trauma and less disturbance of viscera leading to shorter recovery time and less postoperative complication compared with anterior approach. In the present series, 7 patients underwent discectomy via posterolateral approach. To achieve sufficient decompression, we exposed degenerative segment via anterolateral side of spinal canal, and the outcomes are promising. Notably, for cases with mild disc degeneration, we did not performdiscectomy as laminectomy could provide sufficient decompression. Furthermore, for patients with unilateral symptoms and signs, unilateral decompression is recommendable. Recently, many studies reported the use of percutaneous endoscopic discectomy for TLDH. However, this surgical technique is inherent to some limitations,[18–20] and the indications are debatable; hence more researches are required regarding the efficacy and safety of the approach for treating TLDH.

In this series, all patients took oral neurotrophic medication for at least 1 month after discharge. Okada et al[21] considered that methylcobalamin could achieve a high concentration in nerve cells, which can significantly promote synthesis of nucleotide and phosphatides to improve regeneration of axon and myelin sheath of nerves. It can also upgrade the synthesis of nucleic acids and proteins in nerve cells.[22] Some other studies demonstrated that methylcobalamin and nerve growth factor could significantly improve neurological function and relieve pain of patients having operation for lumbar disc herniation. A certain degree of nerve recovery was achieved in the postoperative patients who were not given neurotrophic drugs. However, it was poorer than those given neurotrophic drugs.[23,24] Consequently, we consider that neurotrophic medication may help improve the neurologic function of patients after operation of TLDH.

Acknowledgment

We sincerely thank the contribution of all patients to the publication of this study.

Author contributions

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Methodology: Xiuchun Yu.
Resources: Xiuchun Yu, Weimin Huang.
Writing – original draft: jian kang.
Writing – review & editing: jian kang.

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