Online ISSN : 2314-8969
Print ISSN: 2314-8950
www.esj.journals.ekb.eg

The EGYPTIAN SPINE Journal

CLINICAL ARTICLE EgySpineJ 30:23-30, 2019 DOI: 10.21608/esj.2019.7149.1086

# Herniated Disc at the Upper Lumbar Region: Surgical Technique and Clinical Outcomes

**Ahmed Faisal Toubar, MD.[1], Medhat ElSawy, MD.[2]**

*[1]Neurosurgery Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt*
*[2]Neurosurgery Department, Faculty of Medicine, Al-Minia University, Minia, Egypt*

## ABSTRACT

**Background Data:** Upper lumbar disc herniation involving D12/L1, L1/L2, and L2/L3 levels is less prevalent than lower lumbar discs. In terms of clinical characteristics and surgical managements, they are different from those at the lower levels of the lumbar spine. Spinal canals are narrower than those of the lower levels, which may compromise multiple spinal nerve roots or conus medullaris with higher complication rate with surgical intervention.

**Purpose:** To investigate the clinical features and surgical outcomes of patients operated on for upper lumbar disc herniations.

**Study Design:** Retrospective clinical cohort study.

**Patients and Methods:** This study included 20 patients diagnosed with herniated disc at upper levels (T12-L1, L1-L2, and L2-L3). Patients were operated on during the period between June 2015 to March 2017. All patients were operated on via transfacet approach with pedicle screw fixation. Postoperative data including clinical and neurological outcomes and radiographic imaging have been collected. Postoperative follow-up evaluation included immediate postoperative medical records and a postoperative visit to the outpatient clinic until 18 months postoperatively. Patients' outcomes were assessed using Visual Analogue Scale of radicular and back pain and Oswestry Disability Index (ODI) as functional score.

**Results:** Over a mean follow-up period of 13±2.5 months, there was significant improvement in radicular pain (P = 0.0026) and back pain (P = 0.049) and myelopathy and statistically significant improvement in Oswestry Disability Index (ODI) (P = 0.0032) compared to the preoperative value. No postoperative complications were detected in this series.

**Conclusion:** This approach offers a safe technique for decompression and stabilization at lower thoracic and upper lumbar region. (2019ESJ178)

**Keywords: Upper lumbar spine, facetectomy, transpedicular fixation, degenerative disc disease**

Address correspondence and reprint requests: Ahmed F. Toubar, MD.
Neurosurgery Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt.
Email: ahmadtoubar@yahoo.com

Submitted: January 7th, 2019
Accepted: March 24th, 2019
Published: April 2019

The article does not contain information about medical device(s)/drug(s).
No funds were received in support of this work.
The authors report no conflict of interest.

## INTRODUCTION

Lumbar disc herniation (LDH) is defined as protrusion of disc material beyond the limits of the intervertebral disc space as a result of prolapse of the nucleus pulposus from a defect in the annulus fibrosus.[5] It occurs secondary to degeneration of the intervertebral disc that comes with aging and is most often seen between the third and fifth decades of life.[1]

Usage of the term "upper lumbar" disc is not uniformly defined. Upper lumbar discs have been reported as only L1-L2 and L2-L3 by some authors[5], while others[13] have expanded the definition to include T12-L1 or L3-L4. It was noted that the anatomic characteristics and postoperative outcomes of LDH at L3-L4 are more similar to those of the lower lumbar spine.[19]

Upper LDH is a rare entity that comprises only 5% of all LDH.[13] Upper herniations differ from those occurring at lower levels of the lumbar spine due to the unique anatomy of this region where spinal canals are narrower, lengths of the lamina are shorter, facets are oriented much more parallel to the midsagittal plane, location of pain varies, and direct cord compression may occur.[10] In addition to low back pain and radicular leg pain, there is an increased risk of neural compression and cauda equina syndrome in upper LDHs.[8] Also, they have a less favorable outcome after surgery than lower LDH.[1]

Classic laminectomy and discectomy as a surgical option for upper level herniation are associated with relatively high complication rates secondary to insufficient dural exposure and massive spinal cord retraction during surgery.[16] Transfacet pedicle sparing approach is considered to be a safer approach, enabling macroscopic discectomy through the transfacet region without any cord retraction or breaching the pedicle.[11]

In this retrospective review of our patients' data, we investigated the clinical features and the surgical outcomes of upper lumbar disc herniations operated on via transfacet approach.

## PATIENTS AND METHODS

In this study, we retrospectively reviewed the clinical and neurological presentation, radiological investigations, and operative findings of 20 patients. All patients underwent surgery in Ain Shams University Hospitals in the period between June 2015 and March 2017. We included in this study all patients with symptomatic D12-L1, L1-L2, and L2-L3 disc herniations. Patients with previous spine surgeries, those with associated lower level LDH, and those who underwent only laminectomy without fixation were excluded. Preoperative data collected during review of patients' medical records included low back, radicular pain, motor and/or sensory deficit, reflex changes, sphincter dysfunction, and myelopathy signs. On preoperative magnetic resonance imaging (MRI), disc consistency and direction of herniation were reported.

All patients underwent a discectomy via a posterior transfacet approach which included either unilateral laminectomy or bilateral laminectomy. Under general anesthesia, patients were positioned in the prone position on an operating frame. The correct level of herniated disc was confirmed by fluoroscopy. Unilateral hemilaminectomy in unilaterally symptomatic lesions and medial resection of the zygapophyseal (inferior facet) joint on ipsilateral side were performed. This would allow enough exposure of the disc without overretracting the compressed dural sac. Discectomy was done and cauda and nerve roots were decompressed. Bilateral laminectomy was chosen if the patient complained of bilateral radiating pain, associated severe canal stenosis, and large-sized central disc herniation or presented with cauda equina syndrome. Resection of medial facet was done on the side where discectomy would be done depending on direction of disc herniation. In either case, this is followed by transpedicular screw fixation of this segment.

Postoperative clinical and neurological data were reported; moreover, postoperative plain X-ray and CT images have been collected (Figures 1 and 2). Postoperative follow-up evaluation included

a review of immediate postoperative medical records and a postoperative visit to the outpatient clinic up to 18 months postoperatively. Patients' outcomes were assessed using Visual Analogue Scale (VAS) of the radicular and back pain and Oswestry Disability Index (ODI) as functional score.

Statistical analysis of the data was performed using the SPSS statistical software (version 15.0, Chicago, IL, USA). The multiple logistic regression test was used for the statistical analysis. Statistical significance was set at a probability value (*P* value) of less than 0.05.

## RESULTS

This study included 20 patients, 13 males (65%) and 7 females (35%) with female ratio 1.8:1. Mean age of patients was 45.52±12.5 (range 31–65 years). Overall, 3 patients (20%) had T12-L1 disc herniations, 8 patients (45%) had L1-L2 disc herniations, and 9 patients had L2-L3 disc herniations.

Preoperative clinical features are shown in Figure 3. Some patients (N=6) had described nonspecific leg and back pain, like that of lower lumbar disc herniation. Specific radicular pain or sensory change had been described by 14 patients (70%). One of three patients with T12-L1 showed sensory change in the inguinal area, corresponding to the L1 dermatome; 7 of 8 patients with L1-L2 showed sensory change in the anterior and anterolateral thigh, corresponding to L2 dermatome; 6 of 9 patients with L2-L3 disc herniation showed sensory change corresponding to L3 dermatome. Motor deficit has been reported in 11 patients (55%) including two patients (10%) with T12-L1, five patients (25%) with L1-L2, and four patients (20%) with L2-L3. Partial cauda equina was the initial presentation in six patients (30%) with sphincter dysfunction. The mean preoperative Oswestry Disability Index was 52±12.6.

Radiologic findings of disc level, consistency, and direction of herniation are summarized in Table 1.

This surgical technique has been uniformly performed in all of our twenty patients with uneventful operative and postoperative course. Twelve patients underwent complete bilateral medial facetectomy with unilateral discectomy and bilateral transpedicular screw fixation. Eight patients underwent unilateral complete medial facetectomy with unilateral discectomy and bilateral transpedicular fixation. Intraoperative blood loss was 320±55.9 ml and none of our patients needed either intraoperative or postoperative blood transfusion. The mean hospital stay was 2.5±0.8 days.

Postoperative follow-up period was 13.2±2.5 (range 11–19 months). Radicular pain improved in patients who had a preoperative radicular pain (N=20) with final postoperative VAS 2.5±1.8 ($P<0.05$) when compared to preoperative VAS (7.3±1.8). The preoperative low back pain VAS showed improvement from 4.4±1.09 to 4.05±0.887 ($P=0.049$). Patients presented with the cauda equina syndrome (N=6) showed complete improvement regarding motor deficit and sensory changes, while sphincter dysfunction improved only in four patients documented by postoperative urodynamic studies. Patients presenting with motor deficit (N=11) showed improvement in motor power grade with eight cases returning to grade V motor power on the Medical Research Council Scale (MRCS). Final postoperative ODI was 12±8.3 ($P<0.005$) when compared to preoperative ODI (52±12.6). Postoperative outcomes are summarized in Table 2. Seven patients (35%) had preoperative myelopathic signs in the form of hypertonia and hyperreflexia affecting both lower limbs: four of them showed immediate postoperative reduction of hypertonia and hyperreflexia. The other three patients described improvement over six months postoperatively with regular physical therapy. All patients had postoperative lumbar CT to assess the transpedicular screws purchase; only two patients showed insignificant medial pedicular breach that needed no intervention.

Regular follow-up X-rays in three-month intervals were performed to screen for adjacent segment degeneration and assess for fusion.

Eleven patients (55%) had successful fusion signs by the six months postoperatively, while the other nine patients showed radiologic signs of fusion by the fifteen months postoperatively. None of those patients showed pseudoarthrosis or adjacent segment degeneration.

***Table 1.*** Radiological characteristics of our study patients group.

| Level | No. | Consistency | | Direction | | |
|---|---|---|---|---|---|---|
| | | Soft | Hard | Central | Lateral | Diffuse |
| T12-L1 | 3 | 0 | 3 | 3 | 0 | |
| L1-L2 | 8 | 4 | 4 | 5 | 3 | |
| L2-L3 | 9 | 7 | 2 | 6 | 3 | |

***Table 2.*** Postoperative clinical outcome.

| Parameters | Preoperative | Final postoperative | *P* value |
|---|---|---|---|
| Radicular pain VAS | 7.3±1.8 | 2.5±1.8 | 0.0026 |
| Back pain | 4.4±1.09 | 4.05±0.887 | 0.049 |
| Motor power | 3±1.2 | 4.1±0.7 | 0.05 |
| ODI | 52±12.6 | 12±8.3 | 0.0032 |
| Sphincter dysfunction | 6 | 4 (improved) | |

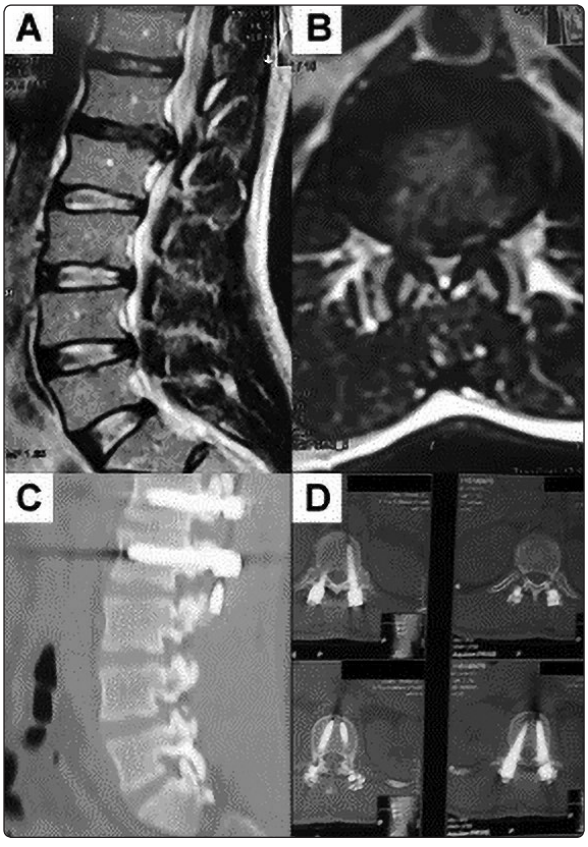


***Figure 1.*** A 35-year-old male presented with radiating pain in right thigh and weakness for three months. Preoperative sagittal (A) and axial (B) T2-weighted MR images showed a marked, diffuse central disc at the L1-L2 level. Postoperative sagittal reconstruction (C) and axial (D) CT images demonstrate the L1-L2 transpedicular fixation.


***Figure 2.*** A 54-year-old male presented with cauda equina for 10 days. Preoperative sagittal (A) and axial (B, C) T2-weighted MR images show a marked, diffuse central disc at the T12-L1 level. Postoperative sagittal reconstruction (D) and axial (E, F) CT images demonstrate complete laminectomy of the T1 with bilateral facetectomy with T12-L1 transpedicular fixation.

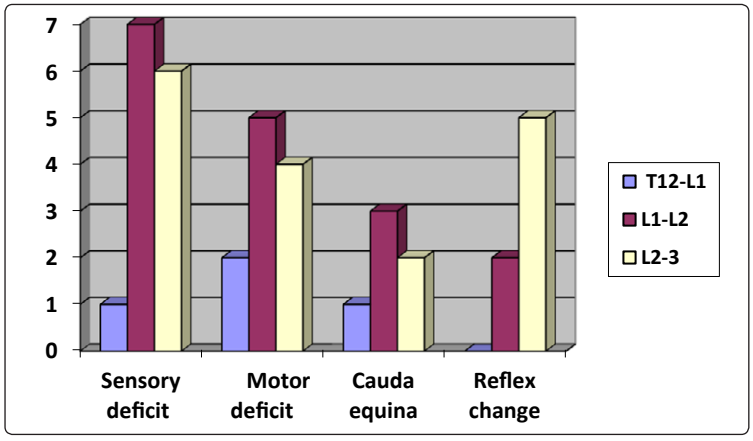


***Figure 3.*** Clinical features of upper lumbar disc herniation according to level.

## DISCUSSION

The majority of LDHs occur in the lower lumbar spine at levels L4-L5 and L5-S1. Upper LDHs occurring at T12-L1, L1-L2, and L2-L3 comprise only 1%-2% of all LDHs. This disparity is likely due to reduced motion and stress at the upper lumbar spine. The presenting symptoms of upper lumbar disc herniations include ill-defined radiculopathies that cannot be clearly categorized into typical muscle group weakness, dermatomal sensory deficits, or reflex deficits. These radiculopathies may be associated with a narrower upper lumbar spinal canal compared with the lower spinal canal, resulting multiple roots being compromised by a single disc herniation.[13]

Manifestations usually have a gradual onset and progressive course; back and lower limbs pain are the most common manifestations and usually precede the development of myelopathy. MRI is the gold standard investigation in diagnosis and can exclude any other pathology. Radiological findings cannot predict the neurological status and hence surgical decision should be taken based on clinical findings that correlate with MRI findings.[10]

According to Fairbank et al.[4], upper LDHs had a higher risk of cauda equina syndrome which was also consistent with our study as 30% of patients had cauda equina syndrome as the initial presenting symptom. Before discussing the different surgical treatments for upper LDH, it is necessary to consider the significant anatomic characteristics of the upper lumbar spine in comparison to lower lumbar spine. According to Masharawi et al.[15] and Satoskar et al.[20], the upper lumbar spine lamina is shorter in length and width. Furthermore, the upper lumbar facets are oriented more parallel to the midsagittal plane compared to the facets of the lower lumbar spine.

The unique characteristics of the upper lumbar spine present surgical challenges in treating upper LDH. The conventional laminectomy for a lumbar discectomy provides only a narrow surgical exposure in the upper lumbar spine. Performing a discectomy in such a limited surgical field can result in overretraction on the thecal sac and places the neural elements at an increased risk of injury. Consequently, this approach was associated with high morbidity; Perot and Munro reported 16 from 90 patients with postoperative paraplegia.[18] Patterson and Arbit[17] noted that 45 % of patients in his study either became paraplegic or showed no improvement.

Upper LDH is being treated with a variety of techniques in addition to the conventional laminectomy. In a case series of nine patients with surgically treated upper LDH, Ido et al.[9] performed discectomy through an anterior approach in five patients with disc protrusions and fusion with autologous rib or iliac bone graft. The authors cited advantages of the anterior approach

including achieving a complete discectomy without manipulation of the dura. However, they also note that the disadvantages of this approach include increased blood loss, longer operating time, increased difficulty of procedure, and risk of peritoneal and vascular injury. Choi et al.[2] have described a posterior transdural approach for calcified upper LDH. The authors noted that two of the four patients did experience transient postoperative mild motor weakness and sensory changes that resolved over one week. A third patient did require one week of lumbar drainage to treat a persistent cerebrospinal fluid (CSF) leak. While this approach preserves bilateral facets, it requires dorsal and ventral durotomies which increase the risk of injury to nerve roots and risk of CSF leak. A microscopic oblique paraspinal approach to perform a discectomy in the upper lumbar spine has also been described. Through this approach, only the anterolateral portion of the ipsilateral facet joint and a 2–5mm strip of the lateral pars are removed. The authors report good clinical outcomes without any spinal instability requiring fusion. This approach is suitable for soft LDHs that are eccentrically located to one side of the spinal canal.[14] However, LDHs with significant bilateral components may not be suitable for this approach, as it does not provide adequate visualization of the central and contralateral sides of the spinal canal.

The use of instrumentation for lumbar fusion has increased recently for treatment of chronic low back pain and degenerative conditions of the lumbar vertebrae. The use of pedicle screw fixation helps to enhance fusion rate, but it also is associated with higher costs and requires a steep learning curve for placement.[12] There is accumulating evidence regarding the safety and efficacy of fusion procedures, which contributed to a more widespread belief that, in selected cases, fusion may be superior to nonsurgical therapy or decompression alone.[12] On the other hand, Zucherman et al.[21] reviewed 871 lumbar fusion procedures performed in eight years; they found that instrumentation in a simple discogenic disease had lower results than simple discectomy, in addition to a higher complication rate and frequent need for removal of fixation systems. If a wide posterior laminectomy was performed to decompress the neural structures, this may lead to disruption of the normal anatomy and mechanics of the spinal column resulting in instability which can lead to surgical failure.[7,12] The addition of spinal fusion guards against the possible instability and adds immediate immobilization of the spinal segment that can improve mainly the axial pain as well as radiculopathy.[6,12] Despite these benefits, it should be taken into consideration the higher incidence of adjacent segment degeneration, higher costs, and higher complication rates.[3]

In our series, complete facetectomy and possible pars interarticularis resection were conducted to obtain an adequate bony exposure offering better visualization of the intervertebral foramen to perform an upper lumbar discectomy safely without cord manipulation or thecal retraction. This was combined with transpedicular screw fixation with lumbar fusion to avoid future postoperative spinal instability. This could be either unilateral which could be suitable for soft laterally situated disc or it could be done bilaterally which is more suitable with central calcified discs that can be accessed bilaterally. Our postoperative results with this approach were satisfactory with improvement of 90 % of myelopathy and radicular pain in all cases when found. There are no reported postoperative complications.

This is 20-patient study with an 18-month follow-up period which is relatively a short-term and small sample study; a further long-term evaluation of a larger number and control group is recommended.

## CONCLUSION

Approaching upper lumbar disc herniation through complete medial facetectomy combined with segmental fixation provides a safe access for decompression, discectomy, and stabilization at upper lumbar region. It offered good clinical outcome, avoiding postoperative complications.

## REFERENCES


1. Albert TJ, Balderston RA, Heller JG, Herkowitz HN, Garfin SR, Tomany K, et al: Upper lumbar disc herniations. J Spinal Disord Tech 6:351-9, 1993
2. Choi JW, Lee JK, Moon KS, Hur H, Kim YS, Kim SH: Transdural approach for calcified central disc herniations of the upper lumbar spine. Technical note. J Neurosurg Spine 7:370-4, 2007
3. Epstein NE: Adjacent level disease following lumbar spine surgery: A review. Surg Neurol Int 6:S591-9, 2015
4. Fairbank J, Hashimoto R, Dailey A, Patel AA, Dettori JR: Does patient history and physical examination predict MRI proven cauda equina syndrome? Evidence-Based Spine-Care Journal 2:27-33, 2011
5. Fardon DF, Milette PC: Nomenclature and classification of lumbar disc pathology. Spine (Phila Pa 1976) 26:E93-E113, 2001
6. Gelalis ID, Kang JD: Thoracic and lumbar fusions for degenerative disorders: rationale for selecting the appropriate fusion techniques. Orthop Clin North Am 29(4):829-42, 1998
7. Grubb SA, Lipscomb HJ: Results of lumbosacral fusion for degenerative disc disease with and without instrumentation. Two- to five-year follow-up. Spine (Phila Pa 1976) 17(3):349-55, 1992
8. He SH, Zhao X, Wu XH, Ding H, Fang J: Percutaneous endoscpic lumbar discectomy for the treatment of upper lumbar disc herniation. Zhongguo Gu Shang 25: 920-2, 2012
9. Ido K, Shimizu K, Tada H, Matsuda Y, Shikata J, Nakamura T: Considerations for surgical treatment of patients with upper lumbar disc herniations. J Spinal Disord Tech 11:75-9, 1998
10. Iwasaki M, Akino M, Hida K, Yano S, Aoyama T, Saito H, et al: Clinical and radiographic characteristics of upper lumbar disc herniation: ten-year microsurgical experience. Neurol Med-Chir 51:423-6, 2011
11. Katayama Y, Matsuyama Y, Yoshihara H, Sakai Y, Nakamura H, Nakashima S, et al: Comparison of surgical outcomes between macro discectomy and micro discectomy for lumbar disc herniation: a prospective randomized study with surgery performed by the same spine surgeon. J Spinal Disord Tech 19:344-7, 2006
12. Katz JN, Lipson SJ, Lew RA, Grobler LJ, Weinstein JN, Brick GW, et al: Lumbar laminectomy alone or with instrumented or noninstrumented arthrodesis in degenerative lumbar spinal stenosis. Patient selection, costs, and surgical outcomes. spine 22:1123-31, 2010
13. Kim DS, Lee JK, Jang JW, Ko BS, Lee JH, Kim SH: Clinical features and treatments of upper lumbar disc Herniations. J Korean Neurosurg Soc 48:119-24, 2010
14. Kim JS, Lee SH, Moon KH, Lee HY: Surgical results of the oblique paraspinal approach in upper lumbar disc herniation and thoracolumbar junction. Neurosurgery 65:95-9, 2009
15. Masharawi Y, Rothschild B, Dar G, Peleg S, Robinson D, Been E, et al: Facet orientation in the thoracolumbar spine: three-dimensional anatomic and biomechanical analysis. Spine (Phila Pa 1976) 29:1755-63, 2004
16. Pasztor E, Szarvas I: Herniation of the upper lumbar discs. Neurosurg Rev 4:151-7, 1981
17. Patterson RH, Jr Arbit E: A Surgical approach through the pedicle to protruded thoracic disc J Neurosurg 48 (5):768-772, 1978
18. Perot PL, Jr Munro DD: Transthoracic removal of midline thoracic disc protrusions causing spinal cord compression. J Neurosurg 31(4):452-8, 1969

19. Sanderson SP, Houten J, Errico T, Forshaw D, Bauman J, Cooper PR: The unique characteristics of "upper" lumbar disc herniations. Neurosurgery 55:385-9, 2004
20. Satoskar S, Goel A, Mehta P, Goel A: Quantitative morphometric analysis of the lumbar vertebral facets and evaluation of the feasibility of lumbar spinal nerve root and spinal decompression using the Goel intraarticular facetal spacer distraction technique: A lumbar/cervical facet comparison. J Crniovertebr Junction Spine 5:157-62, 2014
21. Zucherman J, Hsu K, Picetti G3rd, White A, Wynne G, Taylor L: Clinical efficacy of spinal instrumentation in lumbar degenerative disc disease. Spine (Phila PA 1976) 17(7):834-7, 1992

## الملخص العربي

**الإنزلاق الغضروفي بالمنطقة القطنية العليا: الوسائل الجراحية ونتائجها**

**البيانات الخلفية:** الإنزلاق الغضروفي بالمنطقة القطنية العليا يشمل الغضاريف بين الفقرات الصدرية الثانية عشر والأولى والثانية والثالثة القطنية. وتختلف القناة الشوكية بالمنطقة القطنية العليا عن السفلى حيث أنها أضيق وتشتمل على عدد أكبر من الأنسجة العصبية والتي قد تتأثر بشكل أكبر خلال التدخلات الجراحية.

**الغرض:** تقييم نتائج الجراحة لإستئصال الإنزلاق الغضروفي بالمنطقة القطنية العليا.

**تصميم الدراسة:** هذه الدراسة كانت بأثر رجعي أجريت على عشرين مريضا يعانون من الإنزلاق الغضروفي بالمنطقة القطنية العليا. ولقد تم تقييم المرضى باستخدام المقاييس التالية: مؤشرات الألم البصرية، ومقياس أوسويستري لتقييم العجز.

**المرضى والطرق:** إشتملت الدراسة عشرين مريضا، خضعوا لجراحة إستئصال الغضاريف مع إستخدام التثبيت الخلفي للفقرات لعمل الإلتحام الفقاري مع توسيع القناة الشوكية القطنية. وتم تقييم المرضى كلهم فى خلال زيارات المتابعة التى امتدت لثمانية عشر شهرا.

**النتائج:** أظهرت نتائج هذه الدراسة تحسن ملحوظ إحصائيا ف قياسات الألم للظهر والأطراف السفلية وكذلك التحسن في مقاييس العجز.

**الإستنتاج:** لقد أثبتت جراحة التوسيع للقناة العصبية مع التثبيت الخلفي للفقرات وإستئصال الغضاريف من خلال منطقة المفصل الوجية نجاحا في تحقيق التحسن في أعراض الألم ومقاييس العجز.