Med. J. Cairo Univ., Vol. 93, No. 2, Accepted 7/4/2025
DOI: 10.22608/MJCU. 517-522, June 2025
www.medicaljournalofcairouniversity.net

Conventional Microdiscectomy Versus Tubular Microdiscectomy, A Retrospective Comparative Study

MAHMOUD R. ADLY ALY, M.D.*; HUSSEIN M. HUSSEIN SOFFAR, M.D.** and MOHAMED S. ABDELAZIZ, M.D.*

The Department of Neurosurgery, Faculty of Medicine, Beni-Suef and Cairo** Universities*

Abstract

Background: Lumbar disc prolapse (LDH), which affects millions of people worldwide, is considered one of the most frequent triggers of pain in the lower back and radicular leg.

Aim of Study: This study aimed to compare conventional microdiscectomy and tubular microdiscectomy according to postoperative radiculopathy, back pain, hospital stay, blood loss, complication rate, and return to work (recovery).

Patients and Methods: This was a retrospective comparative study performed on 20 cases who had surgical intervention for lumbar disc prolapse by either conventional microdiscectomy or a tubular microdiscectomy system at Beni-Suef University Teaching Hospitals, Neurosurgery Department, during February 2025, for 1 month to collect and analyze the data.

Results: A statistically insignificant variance has been observed among the groups according to pre- and post-operative Roland Disability Questionnaire scores, preoperative back pain and radiculopathy VAS scores, disc removal weight, blood loss, intraoperative and postoperative complications, or overall recovery ($p>0.05$). However, a significant variation was observed in postoperative back pain VAS scores, as well as operation time and hospital stay ($p<0.05$), indicating variations in surgical efficiency and recovery duration.

Conclusion: The study found insignificant distinctions among groups in demographic factors, clinical characteristics, pre-operative Roland Disability Questionnaire scores, pre-operative back pain, and radiculopathy VAS scores. However, significant differences were observed in the postoperative back pain visual analogue scale, operation time, and hospital stay, suggesting these factors may play a crucial role in distinguishing between groups.

Key Words: *Conventional microdiscectomy – Tubular microdiscectomy – Outcomes.*

Correspondence to: Dr. Mahmoud R. Adly Aly,
E-Mail: Dr.mahmoudramadn@med.bsu.edu.eg

Introduction

LUMBAR disc prolapse (LDH), which affects millions of people worldwide, is considered one of the most frequent triggers of low back pain and radicular leg pain. Distinct surgical methods have evolved to manage such cases as classic open standard techniques, which gave way in the 1970s for Conventional Microdiscectomy (CMD) as a minimally invasive method for treating lumbar disc prolapse since it has been considered the golden standard for lumbar discectomy **[1-4]**.

Conventional microdiscectomy (CMD) involves a midline incision, dissection of the supraspinatus ligament, and tendinous muscular attachment from the posterior spinal bony element, which might result in spinal instability, persistent back pain, as well as even failed back syndrome. Tubular microdiscectomy was 1st described by Greiner-Perth et al., in 2002 as a keyhole, more minimally invasive alternative technique **[5,6]**.

Tubular microdiscectomy offers preservation of the supporting midline ligamentous and muscular structures that have a role in spine stability, and it depends on paramedian muscle separation using tubular retractors (16 to 18mm); thus, the tubular technique offered less postoperative pain, less hospitalization, and early recovery **[4,7]**.

In 1999, Foley and Smith introduced the microdiscectomy (MED). It was the original method that challenged the conventional microdiscectomy **[8]**. Nonetheless, researchers identified a primary limitation of this approach with the growing utilization of endoscopes in spine operations. a restricted operative field observed through a cylindrical tubular retractor the two-dimensional nature of the endoscopic image. To enhance vision and address the re-

stricted working area, tubular retractor devices have recently been combined with microscopy **[9]**. The introduction & utilization of tubular microscopes discectomy (TMD) have been supposed to yield similar or better outcomes to conventional microdiscectomy; nevertheless, this conclusion had not been verified by sufficient evidence **[10]**.

Patients and Methods

This was a retrospective comparative study performed on 20 cases who had surgical intervention for lumbar disc prolapse by either a conventional microdiscectomy or a tubular microdiscectomy system at Beni-Suef University Teaching Hospitals, Neurosurgery Department, during February 2025 for 1 month to collect and analyze the data. Cases have been separated into two groups: Conventional microdiscectomy (N=10) and tubular microdiscectomy (N=10).

Sample size calculation:

This research sample size has been estimated based on the research carried out by Overdevest et al. **[11]**, where the functional status assessed by the Short Form-36 score was 36.7±20.6 in the tubular discectomy compared to 34.9±20.7 in the conventional microdiscectomy. Epi Info has been utilized to determine the sample size based on the following parameters: ninety-five percent two-sided confidence level and eighty percent power. Alpha inaccuracy of five percent. The ultimate maximum sample size derived from the Epi-Info output was fifteen. Consequently, the sample size has been raised to twenty people to account for potential dropout cases during follow-up. The sample size was determined with the subsequent formula:

$$n = \frac{2 \cdot (Z_{1-\alpha/2} + Z_{1-\beta})^2 \cdot \sigma^2}{d^2}$$

Inclusion criteria: Patients with pain in the low back and sciatica with radiological evidence of single-level intervertebral disc prolapse had an operation by either conventional microdiscectomy or a tubular microdiscectomy system.

Exclusion criteria: Cases who had a history of previous lumbar surgery, associated spinal instability, associated spinal pathologies such as scoliosis, vertebral fractures, spine infection, tumor, and inflammatory spondyloarthropathy, andcases who had other procedures for prolapse of lumbar disc.

Methods:

All patients have been subjected to the following:

The following data were obtained from the patients' files from the period of January 2024 to December 2024:

A comprehensive history was taken, including the level and side of herniation. Preoperative pain was assessed using the Visual Analog Scale (VAS), and functional status has been evaluated with the Short Form-36 score. Operative data included operative time and blood loss during surgery. Postoperative outcomes were measured in terms of functional improvement and pain relief, along with patient preference for tubular discectomy. Secondary outcomes included self-perceived recovery, complications, and reoperation incidence.

Operative procedures:

Tubular Microdiscectomy: Under general anesthesia, the case was placed on a radiolucent table in a prone position with bolsters under the pelvis and chest, ensuring abdominal decompression and proper padding of pressure points. Utilizing AP/lateral fluoroscopy, an 18G spinal needle has been inserted one centimeter lateral to the midline at the spinolaminar junction, followed by a 2cm incision and guidewire placement under fluoroscopic guidance. Sequential dilators were inserted to separate muscles before docking an 18mm or 20mm tubular retractor. An operating microscope was introduced, and muscles over the lamina have been resected to expose bony structures. The midline has been confirmed by resecting the spinous process base with a high-speed burr, followed by laminotomy using small Kerrison Laminectomy Rongeurs. The ligamentum flavum was removed with curettes and Kerrison rongeurs, revealing the dura and nerve roots. The nerve root and the thecal sac were carefully retracted, and the herniated disc was excised. Hemostasis was achieved using bipolar cautery or gelfoam. Adequate decompression was confirmed, and closure was performed in layers with 2-0 Vicryl for fascia and subcutaneous tissue and 3-0 Monocryl for skin closure. Fig. (1).

Conventional Microdiscectomy: Case placing was the same as in tubular microdiscectomy. The surgical site was marked utilizing C-arm fluoroscopy in anteroposterior and lateral views, followed by a 4–5cm midline incision on the herniation side. Dissection was carried out via lumbodorsal fascia, subcutaneous tissue, and onto the affected spinous process. A McCullough retractor was inserted to maintain access, and the operating microscope was introduced. If necessary, a burr was used to thin the lamina, and a curette created a plane under the remaining superior lamina and ligamentum flavum. Kerrison rongeurs have been utilized to eliminate bone and ligamentum flavum, creating a working window for discectomy. The dura and nerve root were gently retracted, and the herniated disc was excised utilizing a pituitary rongeur or micro-instrument. Closure was performed in layers, and a single dose of second-generation cephalosporin was administered 30 minutes before surgery. Patients were mobilized the next morning, sutures were removed

at ten to twelve days following the operation, and back muscle strengthening exercises began at two weeks. Follow-ups were conducted for two weeks, three months, six months, and annually thereafter.

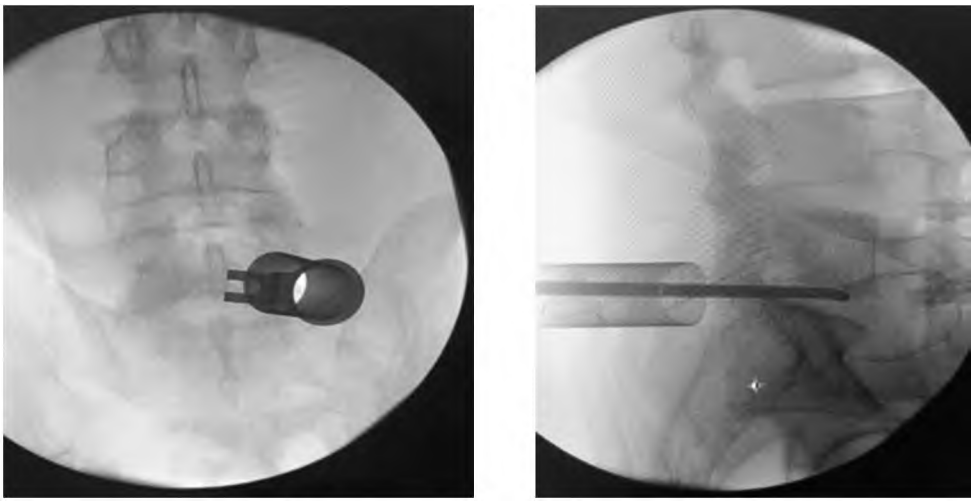

Fig. (1): Intraoperative fluoroscopic images (AP and lateral views) demonstrating precise placement of the tubular retractor system targeting the symptomatic disc space L5-S1.

Results

A statistically insignificant variance has been observed among the examined groups according to age, sex, BMI, micturition disturbance, muscle weakness, and disc herniation level (p>0.05). (Table 1).

A statistically insignificant variance has been observed among the examined groups according to the Roland Disability Questionnaire pre- and post-operative and Back Pain, Radiculopathy Visual Analogue Scale pre-operative p>0.05, while there was a statistically significant difference between the studied groups regarding the Back Pain Visual Analogue Scale post-operative p<0.05. (Table 2).

Table (1): Distribution of characteristics data among the examined groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Age:			
Mean ± SD	41.6±7.7	37.9±6.06	0.24
Sex:			
Male	6 (60%)	5 (50%)	0.65
Female	4 (40%)	5 (50%)	
BMI:			
Mean ± SD	25.0±4.4	24.4±4.2	0.75
Miction disturbance	2 (20%)	1 (10%)	0.53
Muscle weakness	6 (60%)	7 (70%)	0.63
Disc herniation level:			
L3-L4	2 (20%)	2 (20%)	0.86
L4-L5	3 (30%)	2 (20%)	
L5-S1	5 (50%)	6 (60%)	

Table (2): Distribution of Roland Disability Questionnaire and Visual Analogue Scale between the studied groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Roland Disability Questionnaire:			
Pre-operative	15.7±4.5	16.3±4.7	0.77
Post-operative	4.2±1.5	4.7±1.9	0.52
Back pain Visual Analogue Scale:			
Pre-operative	7.3±1.33	8.2±1.22	0.13
Post-operative	3.3±1.15	1.9±0.73	0.001*
Radiculopathy Visual Analogue Scale:			
Pre-operative	8.4±1.26	8.3±0.94	0.84
Post-operative	2.5±1.08	2±0.81	0.25

A statistically insignificant variance has been observed among the examined groups according to the weight of disc removal and blood loss (p>0.05), while there was a statistically significant difference between the studied groups regarding operation time and hospital stay (days) p<0.05. (Table 3).

A statistically insignificant variance has been observed among the examined groups according to intraoperative complications p>0.05. (Table 4).

A statistically insignificant variance has been observed among the examined groups according to post-operative complications p>0.05. (Table 5).

A statistically insignificant variance has been observed among the examined groups according to recovery $p>0.05$. (Table 6).

Table (3): Distribution of Operative data between the studied groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Operation time:			
Mean ŧ SD	33.1ŧ17.4	49.2ŧ17.3	0.05*
Weight of disc removal:			
Mean ŧ SD	6269ŧ3573	6035ŧ2958	0.87
Blood loss:			
Mean ŧ SD	138ŧ47.79	105ŧ34.39	0.09
Hospital stay (days):			
Mean ŧ SD	2.05ŧ0.86	1.35ŧ0.47	0.03*

Table (4): Distribution of intraoperative complications between the studied groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Dural tear	1 (10%)	1 (10%)	0.55
Nerve root injury	0 (0%)	1 (10%)	0.30
Exploration started at wrong level	1 (10%)	0 (0%)	0.30
Other	0 (0%)	1 (10%)	0.30

Table (5): Distribution of post-operative complications between the studied groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Not applicable	7 (70%)	9 (90%)	0.26
Paraesthesia	1 (10%)	1 (10%)	1
Dural tear	1 (10%)	0 (0%)	0.30
Superficial wound infection	1 (10%)	0 (0%)	0.30

Table (6): Distribution of recovery between the studied groups.

	Conventional microdiscectomy Number--ten	Tubular microdiscectomy Number--ten	*p*-value
Return to work:			
Poor	2 (20%)	2 (20%)	0.47
Fair	3 (30%)	3 (30%)	
Good	3 (30%)	5 (50%)	
Excellent	2 (20%)	0 (0%)	

Discussion

Lumbar disc herniation (LDH) denotes the rupture of the fibrous annulus of the intervertebral disc, resulting in the herniation of the nucleus pulposus that compresses the cauda equina and spinal nerve, leading to an inflammatory reaction. The alteration of work and lifestyle habits has led to a significant rise in the prevalence of lumbar disc herniation cases, who are increasingly younger, compromising their mental and physical well-being and rising as a primary health hazard to humanity **[12].**

Lumbar disc herniation (LDH) is a prevalent trigger for lower back pain and sciatica, impacting millions globally. Operation is advised for cases with stubborn radicular symptoms to conservative treatment **[13].**

The findings obtained were as follows:

The present investigation indicated statistically insignificant variations among the examined groups concerning sex, age, body mass index, micturition disturbances, disc herniation level, and muscle weakness.

Consistent with the present research, Bhatia et al. **[14]** aimed to compare immediately following surgery and one-year outcomes of cases having tubular discectomy with those having conventional microdiscectomy, while also assessing the learning curve as well as complication rates associated with tubular discectomy. Their findings indicated statistically insignificant variations among the groups concerning sex (p=0.733), age (p=0.534), and disc herniation level (p=0.072).

The reported findings have been confirmed by **[7]**, which aimed to assess the 5-year outcomes of tubular microdiscectomy in comparison to conventional microdiscectomy. They revealed statistically insignificant distinctions among the tubular microdiscectomy (TMD) as well as conventional microdiscectomy (CMD) groups concerning age (mean = 41.6±9.8 vs. 41.3±11.7), sex (male distribution = 51% vs. 55%), body mass index (mean = 26.0±4.4 vs. 25.4±4.2), micturition disturbance (17% vs. 13%), muscle weakness (63% vs. 66%), and the level of disc herniation, with means and distributions provided for both TMD and CMD groups, correspondingly.

The results indicated statistically insignificant variance among the examined groups concerning the Roland Disability Questionnaire pre- and post-operatively, as well as the pre-operative Back Pain and Radiculopathy Visual Analogue Scale. However, a statistically significant distinction has been observed among the groups in terms of the following surgery Back Pain Visual Analogue Scale.

This research corroborates the findings of Bhatia et al. **[14]**, who demonstrated that the recovery

rate for tubular discectomy was significantly higher compared to that of conventional microdiscectomy, noting a significant enhancement in VAS scores for back pain across all three groups at one week ($p \leq 0.001$).

Overdevest et al. [11] demonstrated an insignificant distinction has been observed among the TMD and CMD groups with the preoperative and postoperative Roland Disability Questionnaire and VAS for back pain.

The current investigation revealed statistically insignificant variations among the groups for disc removal weight and blood loss; however, there was a statistically significant variation in operation time and hospitalization duration.

Similarly, the current study aligned with Overdevest et al., [11] as they indicated that the mean weight of disc removal was (6104±3555mg vs. 6877±3573mg), Blood loss found in 150 (92%) vs. 135 (85%) patients, the mean of operation time was (47±22min vs. 36±16min) and the mean of hospitalization was (3.3±1.2 days vs. 3.3±1.1 days) in (TMD) and (CMD) groups; respectively, a statistically insignificant variance has been observed among the examined groups according to Weight of disc removal (p=0.08) and Blood loss (p=0.08) while a statistically significant variance has been observed among the studied groups regarding Operation time (p<0.001) meanwhile they reported statistically insignificant variance regarding Hospital stay (days) (p=0.82).

As well, the obtained findings aligned with Bhatia et al. [14], who conducted their study on forty-six patients with microdiscectomy and 102 (group 1; 48 patients had tubular discectomy between July 2009 and December 2010 and group 2; 54 patients had tubular discectomy between January 2011 and June 2012). They demonstrated a statistically significant variance has been observed between conventional microdiscectomy and the 2 tubular discectomy groups according to operation time (p<0.001) and between conventional microdiscectomy and only the group 2 regarding hospital stay. In contrast, they revealed a statistically significant variance has been observed among the tubular discectomy groups and conventional microdiscectomy regarding blood loss (p<0.001).

The present results indicated a statistically insignificant variance observed among the studied groups regarding intraoperative complications or postoperative complications.

In alignment with the current findings, Overdevest et al. [11], in their research involving 325 cases with symptomatic lumbar disc herniation, assigned participants to either conventional microdiscectomy (159 cases) or tubular microdiscectomy (166 cases). Their results indicated a statistically insignificant distinction among tubular microdiscectomy (TMD) and conventional microdiscectomy (CMD) concerning intraoperative complications (p=0.27), which encompassed dural tears, nerve root injury, incorrect level exploration, and others, as well as complications following the procedure (p=0.47), involving wound infection and others.

Wang et al. [15], who assessed the efficiency of TMD versus CMD for lumbar disc herniation (LDH), found a statistically insignificant distinction among TMD and CMD concerning intraoperative complications (dural tear and nerve root injury).

The results indicated statistically insignificant variance has been observed in recovery among the groups examined.

Consistent with the reported findings, Overdevest et al. [11] found that long-term functional and clinical outcomes didn't differ among cases assigned to tubular microdiscectomy and those assigned to conventional microdiscectomy. They stated that seventy-seven percent of cases undergoing conventional discectomy had complete or near-complete symptom recovery, compared to seventy-four percent of cases undergoing tubular discectomy, with no statistically significant distinction among the TMD and CMD groups regarding recovery (p=0.79).

Conclusion:

The research found insignificant differences between groups in demographic factors, clinical characteristics, pre-operative Roland Disability Questionnaire scores, pre-operative back pain, and radiculopathy visual analogue scale scores. However, significant differences were observed in post-operative back pain VAS, operation time, and hospital stay, suggesting these factors could play a crucial role in distinguishing between groups.

References

1- YASARGIL M.G.: Microsurgical operation of herniated lumbar disc. InLumbar Disc Adult Hydrocephalus 1977 Sep (pp. 81-81). Berlin, Heidelberg: Springer Berlin Heidelberg.

2- CASPAR W.: A new surgical procedure for lumbar disc herniation causing less tissue damage through a microsurgical approach. Lumbar Disc Adult Hydrocephalus, 4: 74–80, 1977. [Google Scholar].

3- WILLIAMS R.W.: Microlumbar discectomy: a conservative surgical approach to the virgin herniated lumbar disc. Spine (Phila Pa 1976), 3: 175–82, 1978. [PubMed] [Google Scholar].

4- RIESENBURGER R.I. and DAVID C.A.: Lumbar microdiscectomy and microendoscopic discectomy. Minim Invasive Ther Allied Technol., 15: 267–70, 2006. [PubMed] [Google Scholar].

5- TAYLOR R.S.: Spinal cord stimulation in complex regional pain syndrome and refractory neuropathic back and leg pain/failed back surgery syndrome: Results of a systematic review and meta-analysis. J. Pain Symptom Manage, 31 (Suppl): S13–9, 2006. [PubMed] [Google Scholar].

6- KATAYAMA Y., MATSUYAMA Y. and YOSHIHARA H.: 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. [PubMed] [Google Scholar].

7- DONG Y.L.: Posterior microscopic lesionectomy for lumbar disc herniation with tubular retraction using METRxTM system. J. Korean Neurosurg Soc., 41: 69-169, 2006. [Google Scholar].

8- PEREZ-CRUET M.J., FOLEY K.T. and ISAACS R.E.: Microendoscopic lumbar discectomy: Technical note. Neurosurgery, 51: S129–36, 2002. [PubMed] [Google Scholar].

9- GREINER-PERTH R., BÖHM H. and SAGHIR H.E.: Microscopically assisted percutaneous nucleotomy, an alternative minimally invasive procedure for the operative treatment of lumbar disc herniation: preliminary results. Neurosurg. Rev., 25: 225–7, 2002. [PubMed] [Google Scholar].

10- ARTS M.P., BRAND R. and VAN DEN AKKER M.E.: Tubular diskectomy vs conventional microdiskectomy for sciatica: A randomized controlled trial. JAMA, 302: 149–58, 2009. [PubMed] [Google Scholar].

11- OVERDEVEST G.M., PEUL W.C., BRAND R., KOES B.W., BARTELS RHMA, TAN W.F., et al.: Tubular discectomy versus conventional microdiscectomy for the treatment of lumbar disc herniation: Long-term results of a randomised controlled trial. J. Neurol. Neurosurg. Psychiatry, 88 (12): 1008–16, 2017.

12- YU P., MAO F., CHEN J., MA X., DAI Y. and LIU G.: Characteristics and mechanisms of resorption in lumbar disc herniation. Arthritis Res. Ther., 24 (1): 205, 2022.

13- LI X., CHANG H. and MENG X.: Tubular microscopes discectomy versus conventional microdiscectomy for treating lumbar disk herniation: Systematic review and meta-analysis. Medicine (Baltimore), 97 (5): e9807, 2018.

14- BHATIA P.S., CHHABRA H.S., MOHAPATRA B., NANDA A., SANGODIMATH G. and KAUL R.: Microdiscectomy or tubular discectomy: Is any of them a better option for management of lumbar disc prolapse. J. Craniovertebr Junction Spine, 7 (3): 146–52, 2016.

15- WANG Y., LIANG Z., WU J., TU S. and CHEN C.: Comparative clinical effectiveness of tubular microdiscectomy and conventional microdiscectomy for lumbar disc herniation: A systematic review and network meta-analysis. Spine. Jul 15; 44 (14): 1025-33, 2019.

دراسة مقارنة بين نتائج الاستئصال الميكروسكوبى التقليدى والاستئصال الميكروسكوبى الانبوبى فى علاج الانزلاق الغضروفى القطنى

يُعد الانزلاق الغضروفى القطنى من الأسباب الرئيسية لآلام أسفل الظهروالأعراض الجذرية فى الساق، ويؤثرعلى ملايين الأشخاص حول العالم. ويُعتبر من أكثر الحالات الشائعة التى تتطلب تدخلاً جراحيًا عند فشل العلاج التحفظى.

هدفت هذه الدراسة إلى مقارنة النتائج بين الاستئصال المجهرى التقليدى للغضروف القطنى واستخدام نظام الاستئصال المجهرى عبر أنبوب، وذلك من حيث الألم الجذرى بعد الجراحة، وآلام الظهر، ومدة البقاء فى المستشفى، وفقدان الدم أثناء الجراحة، ومعدل المضاعفات، ومدة العودة إلى العمل (فترة التعافى).

خلص البحث إلى وجود فروق طفيفة بين المجموعات فى العوامل الديموغرافية، والخصائص السريرية، ودرجات استبيان رولاند للإعاقة قبل الجراحة، وآلام الظهر قبل الجراحة، ودرجات مقياس التناظر البصرى لاعتلال الجذور. ومع ذلك، لوحظت فروق كبيرة فى مقياس التناظر البصرى لآلام الظهر بعد الجراحة، ومدة العملية، ومدة الإقامة فى المستشفى، مما يشير إلى أن هذه العوامل قد تلعب دورًا حاسمًا فى التمييز بين المجموعات.