



## The Effect of Cortisone Use on Epidural Fibrosis in Lumbar Microdiscectomy: Evaluation of 359 Patients

Ozgur Akşan<sup>1</sup>, Nail Ozdemir<sup>2</sup> & Caglar Turk<sup>3</sup>

<sup>1</sup>Department of Neurosurgery, Istanbul Aydın University, Istanbul, Turkey

<sup>2</sup>Department of Neurosurgery, Izmir Dokuz Eylul University, Izmir, Turkey

<sup>3</sup>Department of Neurosurgery, University of Health Sciences, Izmir, Turkey

Corresponding author: Ozgur Akşan (e-mail: [ozguraksan@gmail.com](mailto:ozguraksan@gmail.com) ).

©2024 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)

**Abstract: Background and Objectives** The purpose of this study is to evaluate the effect of corticosteroid use during lumbar microdiscectomy surgery on the development of epidural fibrosis. Epidural fibrosis is a common postoperative complication that can increase the risk of pain recurrence and surgical failure. Corticosteroids are used during surgery for their anti-inflammatory properties, aiming to reduce fibrosis formation. However, the effectiveness of corticosteroids in preventing fibrosis remains controversial. **Methods** This retrospective study analyzed data from 359 patients who underwent lumbar microdiscectomy surgery between 2011 and 2022. Patients were divided into two groups: Group A (corticosteroid used during surgery) with 201 patients and Group B (no corticosteroid used during surgery) with 158 patients. The development of fibrosis was assessed through clinical follow-up and imaging studies. **Results** In Group A, fibrosis developed in 2 out of 201 patients (0.99%), while in Group B, fibrosis developed in 5 out of 158 patients (3.16%). Statistical analysis showed no statistically significant difference between the two groups in terms of fibrosis development ( $P=0.140$ ). **Conclusion** This study found no statistically significant effect of corticosteroid use during lumbar microdiscectomy on the prevention of epidural fibrosis. Additionally, no severe postoperative complications were observed in either group. Further extensive studies are required to better understand the long-term effects and potential side effects of corticosteroids. Future research should investigate different types of corticosteroids and application protocols in more detail.

**Keywords:** Lumbar microdiscectomy, epidural fibrosis, corticosteroid, postoperative complications, retrospective study.

### INTRODUCTION

Lumbar disc surgeries are common surgical interventions aimed at reducing nerve root compression to alleviate pain and other neurological symptoms in patients. However, the development of epidural fibrosis in the postoperative period is a complication that can lead to recurrent pain and surgical failure. Epidural fibrosis is the replacement of normal epidural fat tissue with scar tissue in the postoperative period. This condition can lead to compression of the nerve roots and the dural sac, causing symptoms such as pain, neurological deficits, and movement restrictions.

Direct compression of the nerve roots and the ensuing inflammatory reaction are the sources of pain related to lumbar disc herniation (5,7). When conservative therapy is unsuccessful, discectomy is the course of treatment for lumbar disc herniation. Discectomy greatly reduces radicular symptoms and postoperative back discomfort. Peridural fibrosis and arachnoiditis are considered to be the causes of persistent postoperative nerve root discomfort (13,16).

Following a surgical laminectomy, dense scar tissue

forms next to the dura mater; this is known as postoperative epidural fibrosis, and it is the body's normal healing response to the surgical procedure (2,14,20). It has been claimed that up to 5% of surgical failures after decompressive surgery are caused by epidural fibrosis. Fibrosis raises the possibility of dural rips, iatrogenic injuries, and nerve root injury in addition to making re-examination of the surgical site technically difficult. In the field of spinal surgery, preventing epidural fibrosis has been extensively studied. Following lumbar laminectomy and discectomy, the production of dense and thick epidural scar tissue is associated with unfavorable clinical results and recurrent complaints, such as back pain and/or radiculopathy. After surgery, the epidural space is often injured, which is how epidural fibrosis starts.

Fibroblasts, which originate from neighboring paraspinal muscles, are the cells that cause fibrosis. The post-laminectomy membrane, as defined by LaRocca and Macnab in 1974, is formed when this physiological scar changes into a hypertrophic covering film (12). The creation of epidural fibrosis is caused by the spread of dense fibrotic tissue into the postoperative hematoma

**How to cite:** Akşan, Ozgur, Nail Ozdemir, and Caglar Turk. "The Effect of Cortisone Use on Epidural Fibrosis in Lumbar Microdiscectomy: Evaluation of 359 Patients." *Journal of Pioneering Medical Sciences*, vol. 13, no. 6, 2024, pp. 120-125.

from the deep surface of the paravertebral muscles and the fibrous layer of the periosteum (12). Radicular discomfort is one of the recurring symptoms that can result from this extradural fibrotic tissue extending into the spinal canal and adhering to the dura mater and nerve roots (3,8).

Corticosteroids are used during surgery for their anti-inflammatory and immunosuppressive properties, aiming to reduce fibrosis formation. However, the effectiveness of corticosteroids in preventing epidural fibrosis remains controversial. Some studies suggest that corticosteroids are effective in reducing fibrosis formation, while others indicate that this effect is limited or nonexistent. The growth of this tissue is intended to be prevented or limited by a variety of strategies, including as surgical techniques, anti-inflammatory medications, and the use of biological and synthetic materials as mechanical barriers between the dura and overlying tissue. For many years, epidural steroids have been used as a lumbar disc disease surgical adjuvant. By reducing late-stage scar formation and early postoperative inflammatory reactions, the use of these drugs attempts to minimize postoperative discomfort (1,9,15).

Ranguis et al. published a systematic review of 12 studies on this topic between 1992 and 2008 (17). The purpose of this study is to evaluate the effect of corticosteroid use during lumbar microdiscectomy on the development of epidural fibrosis. This retrospective study aims to determine the effectiveness of corticosteroids by comparing the rates of fibrosis development in patients with and without corticosteroid use.

## MATERIALS AND METHODS

### Clinical Study Design

This retrospective study analyzed data from 359 patients who underwent lumbar microdiscectomy surgery between 2011 and 2022. Patients were divided into two groups: Group A (corticosteroid used during surgery) and Group B (no corticosteroid used during surgery). In Group A, 201 patients received 2.0 ml of methylprednisolone (Prednol-L 40 mg vial, Mustafa Nevzat, Turkey) into the dural space. Epidural fibrosis diagnoses were made through postoperative magnetic resonance imaging (MRI) examinations (Table-1).

**Table 1:** Comparison of patients with and without corticosteroid use (Group A and Group B).

Patient Group	Total Number of Patients	Cortisone Use	Number of Patients with Fibrosis	Fibrosis Development Rate (%)
Group A	201	Yes	2	0.99
Group B	158	No	5	3.16
Total	359		7	

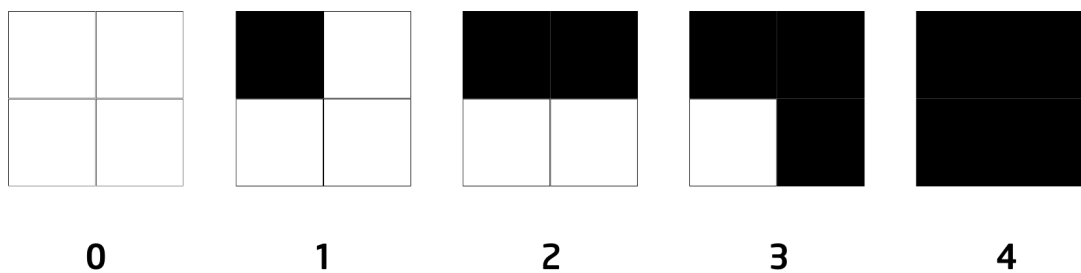
In this study, the effects of corticosteroid use and non-use on postoperative complications were also evaluated. There was no significant difference between Group A (corticosteroid used during surgery) and Group B (no corticosteroid used during surgery) in terms of intraoperative and postoperative complications. No serious complications such as postoperative infection, wound healing problems, or neurological deficits were observed in either group.

### MRI Evaluation

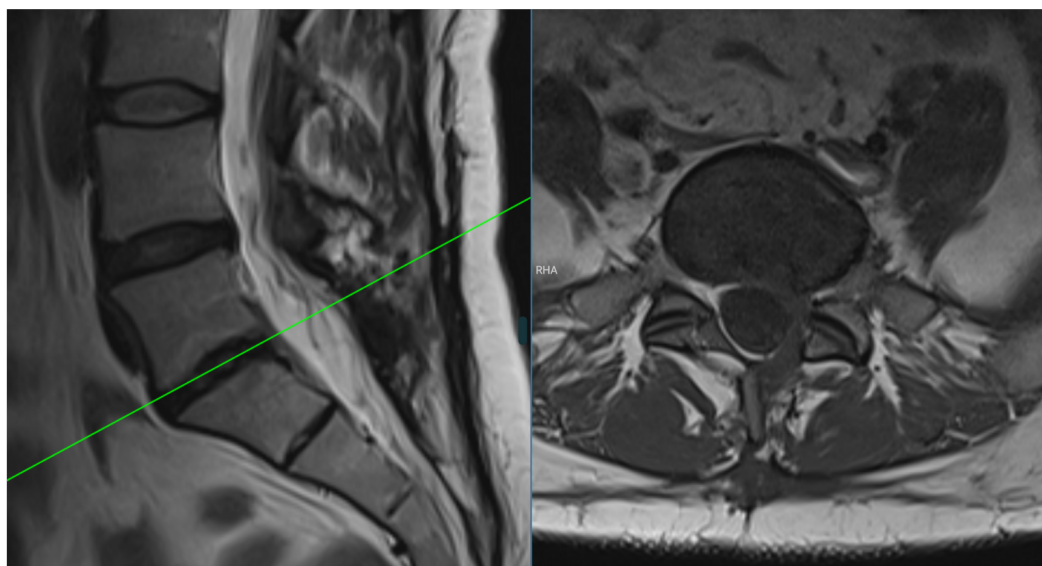
An iso-hypointense signal on T1-weighted MR images relative to intervertebral discs that obscures the typical epidural fat signal intensity is the standard for identifying an epidural scar. Epidural fibrosis is a fairly homogeneous condition that typically forms a curving pattern surrounding the dural tube. Since a mass effect

can be seen in both herniated discs and fibrosis, its presence or absence is not a diagnostic criterion. One indicator of scarring is the dural tube's retraction toward the soft tissue side. Regardless of whether it is anterior, lateral, or posterior to the thecal sac, scar tissue grows steadily right after contrast agent injection. Polypoid in shape, recurrent herniations typically have a smooth outer margin. After 10 minutes, residual disk material does not improve.

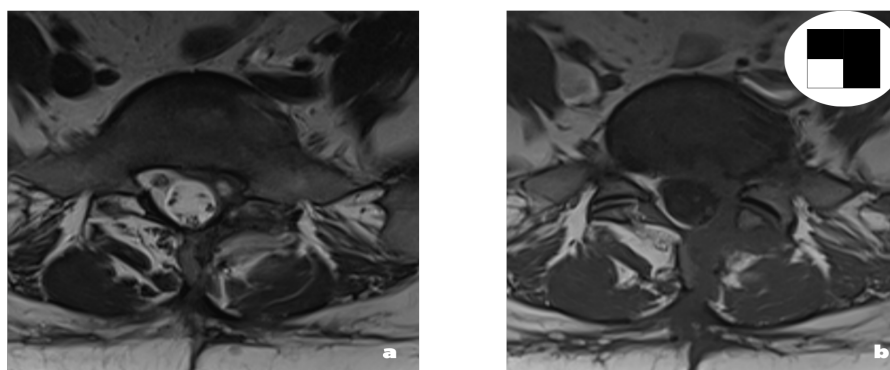
- 0: No scar or evidence of one
- 1: Scars fill 0–25% of the quadrant.
- 2: Scars cover 25 to 50% of the quadrant.
- 3: Scars cover 50–75% of the quadrant.
- 4: Scars cover 75–100% of the quadrant.



**Image 1:** Grading of Epidural Fibrosis



**Image 2:** Epidural fibrosis developed after discectomy at the L5-S1 level



**Image 3:** Grade 2 epidural fibrosis in axial T2-weighted MRI image (a) and Grade 3 epidural fibrosis in axial T1-weighted MRI image (b).

### **Surgical Technique**

All patients underwent a midline incision of 3-5 cm over the designated segment. No infiltration was performed on the skin or paraspinal muscles before the incision. After the skin incision, the paraspinal muscles were unilaterally detached from the spinous process and lamina of the vertebra on the side of the herniation using a cautery device. Throughout the procedure, the interspinous and supraspinous ligaments were preserved without injury. After removing the ligamentum flavum, the nerve root was retracted medially, and the herniated disc was removed. Following meticulous hemostasis, 2.0 ml of methylprednisolone (Prednol-L 40 mg vial, Mustafa Nevzat, Turkey) was applied over the decompressed nerve root in the steroid group. No medication was applied to the nerve root in the control group. The wound was closed without drainage.

### **Data Collection**

The development of fibrosis was assessed through clinical evaluations and imaging studies in the postoperative period. Demographic data, preoperative and postoperative clinical findings, and imaging results were retrospectively obtained from patient files and the hospital information system.

### **Ethical Approval**

This study was approved by the Ethics Committee of Tepecik Education and Research Hospital (approval number: 2022/12-36) and was conducted in accordance with the 1964 Declaration of Helsinki and its subsequent amendments. Written informed consent was obtained from all participants.

### **Statistical Methods**

Software from IBM Corporation, Armonk, New York, USA, called SPSS 25.0 was used to analyze the data. Category variables were the only ones that were compared using the Fisher exact test. Categorical variables are displayed in tables as n (%), whereas quantitative variables are given as Median (Minimum / Maximum). A 95% confidence interval was used, and statistical significance was defined as p-values less than 0.05.

## **RESULTS**

In this study, Group A, where corticosteroids were used during surgery, comprised a total of 201 patients. In this group, only 2 patients (0.99%) developed epidural fibrosis. In Group B, where no corticosteroids were used, there were a total of 158 patients, and 5 patients (3.16%) developed epidural fibrosis. Statistical analysis showed no statistically significant difference between the two groups in terms of the development of fibrosis ( $P=0.140$ ).

Although a lower incidence of fibrosis was observed in

the group where corticosteroids were used, this difference was not statistically significant. This suggests that the effectiveness of corticosteroids in preventing epidural fibrosis is limited or that the methods used in this study did not have sufficient sensitivity to assess fibrosis development.

The lack of statistical significance between Group A and Group B in terms of fibrosis development rates aligns with the conflicting results in the literature regarding the effect of corticosteroids on epidural fibrosis. Some studies suggest that corticosteroids are effective in reducing fibrosis development, while others indicate that this effect is limited or nonexistent. The results of this study also support this complexity in the literature.

In Group A, no infections, wound healing issues, or neurological deficits were found in patients who received corticosteroids. Similarly, in Group B, no such complications were observed in patients who did not receive corticosteroids. These findings suggest that the use of corticosteroids does not lead to serious postoperative complications and is a safe method.

The data obtained in this retrospective study indicate that the use of corticosteroids during surgery does not provide a significant advantage in preventing epidural fibrosis. However, prospective studies with larger patient groups and longer follow-up periods are needed to obtain more definitive results. In light of the current data, further research is needed to determine the effectiveness of corticosteroids in preventing epidural fibrosis.

## **DISCUSSION**

In this study, the effect of corticosteroid use during lumbar microdiscectomy surgery on the development of postoperative epidural fibrosis was evaluated. The findings indicate that corticosteroid use does not have a statistically significant effect on preventing fibrosis development. In the literature, corticosteroids are suggested to reduce fibrosis development due to their anti-inflammatory effects; however, some studies indicate that this effect is limited or nonexistent. Our study similarly found no significant effect of corticosteroid use on fibrosis development.

Since it is linked to a lower rate of postoperative complications, efficient pain management following surgery for degenerative lumbar illness is crucial (17). After disc surgery, pain is linked to a number of things, including tissue damage and an inflammatory chain reaction brought on by direct manipulation of the nerve root. During lumbar disc surgery, intraoperative epidural steroids have been utilized as an extra pain reliever. By decreasing pain and inflammation



**How to cite:** Akşan, Ozgur, Nail Ozdemir, and Caglar Turk. "The Effect of Cortisone Use on Epidural Fibrosis in Lumbar Microdiscectomy: Evaluation of 359 Patients." *Journal of Pioneering Medical Sciences*, vol. 13, no. 6, 2024, pp. 120-125.

mediators such as prostaglandins, leukotrienes, bradykinin, and histamine, these steroids are hypothesized to lessen postoperative discomfort (6). Additionally, it is theorized that steroids lessen pain by decreasing scar formation following lumbar surgery and preventing epidural fibrosis (9).

For more than 20 years, intraoperative epidural steroids have been recommended (4). Extensive research has been conducted in recent years to find a method or substance that can prevent excessive scar development and preserve the proper anatomical planes of various tissues. However, efforts to reduce the formation of scars through different surgical approaches, local anti-inflammatory medications, and biological and synthetic materials—like polylactic acid, gel foam, Avitene, free fat grafts, Gore-Tex membranes, and ADCON-L—have generally produced mixed results (6, 10, 11, 19).

We looked into the theory that by adding methylprednisolone to the area between the surrounding soft tissues and the dura mater, we could lessen the degree of epidural fibrosis and stop the tissues from sticking to the dura mater. Ranguis et al. released the initial comprehensive analysis of 12

In a study by Diaz and colleagues evaluating the effectiveness of epidural analgesic pastes used for pain management after lumbar decompressive surgery, 201 patients were randomly assigned to one of four different drug applications in a randomized, double-blind, controlled trial: combination drug (morphine and methylprednisolone), steroid drug (methylprednisolone alone), morphine drug (morphine alone), and placebo. Significant reductions in pain and analgesic consumption were observed in the combination drug and steroid drug groups in the first three days post-surgery. No similar effect was seen in the morphine drug group. Additionally, no differences were found between the groups in terms of time to ambulation and discharge from the hospital, general health, and neurological recovery. The study concluded that analgesic drugs containing methylprednisolone were effective in reducing postoperative pain, but the addition of morphine weakened this effect. These findings suggest that methylprednisolone plays an important role in postoperative pain management (9).

However, given the potential long-term effects and side effects of corticosteroids, more comprehensive studies are needed. The potential immunosuppressive effects of corticosteroids may increase the risk of infection or affect wound healing processes in the long term. Therefore, prospective and long-term follow-up studies are needed to evaluate the long-term outcomes of postoperative corticosteroid use.

## CONCLUSIONS

In our study, the effect of corticosteroid use during lumbar microdiscectomy surgery on the development of postoperative epidural fibrosis was evaluated. The findings indicate that corticosteroid use does not have a statistically significant effect on preventing fibrosis development. In the literature, corticosteroids are suggested to reduce fibrosis development due to their anti-inflammatory effects; however, some studies indicate that this effect is limited or nonexistent. Our study similarly found no significant effect of corticosteroid use on fibrosis development.

Our results indicate that the use of corticosteroids during surgery is not an effective method for preventing fibrosis formation. However, some studies in the literature report varying results with different doses or application methods of corticosteroids. Therefore, evaluating the effects of corticosteroids on postoperative fibrosis with more comprehensive and controlled studies will contribute to obtaining more precise and reliable results in surgical applications. In conclusion, this study shows that the use of corticosteroids during lumbar microdiscectomy surgery does not provide a significant advantage in preventing postoperative epidural fibrosis. Future research should examine different types of corticosteroids and application protocols in more detail to address this issue comprehensively.

## REFERENCES

1. Abrishamkar, Saeid, et al. "The effect of impregnated autogenous epidural adipose tissue with bupivacaine, methylprednisolone acetate or normal saline on postoperative radicular and low back pain in lumbar disc surgery under spinal anesthesia; a randomized clinical trial study." *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences* 16.5 (2011): 621.
2. Alkalay, R. N., et al. "Prevention of Postlaminectomy Epidural Fibrosis Using Bioelastic Materials." *Spine (Philadelphia, Pa. 1976)* 28.15 (2003): 1659-1665. doi: 10.1097/01.BRS.0000083161.67605.40
3. Burton, C. V. "Causes of Failure of Surgery on the Lumbar Spine: Ten-Year Follow-Up." *Mount Sinai Journal of Medicine* 58.2 (1991): 183-187. PMID: 1857365.
4. Davis, R., and S. E. Emmons. "Benefits of Epidural Methylprednisolone in a Unilateral Lumbar Discectomy: A Matched Controlled Study." *Journal of Spinal Disorders* 3.4 (1990): 299-306; discussion 307. PMID: 2134443.

5. Debi, R., et al. "Local Application of Steroids Following Lumbar Discectomy." *Journal of Spinal Disorders & Techniques* 15.4 (2002): 273-276.  
[https://journals.lww.com/jspinaldisorders/abstract/2002/08000/local\\_application\\_of\\_steroids\\_following\\_lumbar.2.aspx](https://journals.lww.com/jspinaldisorders/abstract/2002/08000/local_application_of_steroids_following_lumbar.2.aspx)
6. Foulkes, G. D., and J. S. Robinson Jr. "Intraoperative Dexamethasone Irrigation in Lumbar Microdiscectomy." *Clinical Orthopaedics and Related Research* 261 (1990): 224-228. PMID: 2245548.
7. Gertzbein, S. D. "Degenerative Disk Disease of the Lumbar Spine: Immunological Implications." *Clinical Orthopaedics and Related Research* 129 (1977): 68-71
8. Gill, G. G., et al. "Pedicule Fat Grafts for the Prevention of Scar in Low-Back Surgery: A Preliminary Report on the First 92 Cases." *Spine (Philadelphia, Pa. 1976)* 10.7 (1985): 662-667.
9. Häckel, M., et al. "The Epidural Steroids in the Prevention of Epidural Fibrosis: MRI and Clinical Findings." *Neuro Endocrinology Letters* 30.1 (2009): 51-55. PMID: 19300380. <http://node.nel.edu>
10. Jamjoom, B. A., and A. B. Jamjoom. "Efficacy of Intraoperative Epidural Steroids in Lumbar Discectomy: A Systematic Review." *BMC Musculoskeletal Disorders* 15 (2014): 146. <https://doi.org/10.1186/1471-2474-15-146> PMID: 24885519; PMCID: PMC4014751.
11. Kemaloglu, S., et al. "Prevention of Spinal Epidural Fibrosis by Recombinant Tissue Plasminogen Activator in Rats." *Spinal Cord* 41.8 (2003): 427-431. doi: 10.1038/sj.sc.3101466. PMID: 12883539.
12. LaRocca, H., and I. Macnab. "The Laminectomy Membrane: Studies in Its Evolution, Characteristics, Effects and Prophylaxis in Dogs." *Journal of Bone and Joint Surgery - British Volume* 56B.3 (1974): 545-550. PMID: 4421702. <https://doi.org/10.1302/0301-620X.56B3.545>
13. Lindblom, K., and B. Rexed. "Spinal Nerve Injury in Dorso-Lateral Protrusions of Lumbar Disks." *Journal of Neurosurgery* 5.5 (1948): 413-432. PMID: 18885345. <https://doi.org/10.3171/jns.1948.5.5.0413>
14. Masopust, V., et al. "Postoperative Epidural Fibrosis." *Clinical Journal of Pain* 25.7 (2009): 600-606. PMID: 19692802. DOI: 10.1097/AJP.0b013e3181a5b665
15. Modi, H., et al. "Local Application of Low-Dose Depo-Medrol Is Effective in Reducing Immediate Postoperative Back Pain." *International Orthopaedics* 33.3 (2009): 737-743. doi: 10.1007/s00264-008-0547-6.
16. Murphy, R. W. "Nerve Roots and Spinal Nerves in Degenerative Disk Disease." *Clinical Orthopaedics and Related Research* 129 (1977): 46-60. doi: 10.1097/00003086-197711000-00005. PMID: 608296.
17. Ranguis, S. C., et al. "Perioperative Epidural Steroids for Lumbar Spine Surgery in Degenerative Spinal Disease: A Review." *Journal of Neurosurgery: Spine* 13.6 (2010): 745-757. doi: 10.3171/2010.6.SPINE09796. PMID: 21121754.
18. Ross, J. S., et al. "MR Evaluation of Epidural Fibrosis: Proposed Grading System with Intra- and Inter-Observer Variability." *Neurological Research* 21, suppl. 1 (1999): S23-26. doi: 10.1080/01616412.1999.11758604. PMID: 10214567.
19. Temel, S. G., et al. "A New Material for Prevention of Epidural Fibrosis After Laminectomy: Oxidized Regenerated Cellulose (Interceed), an Absorbable Barrier." *Journal of Spinal Disorders & Techniques* 19.4 (2006): 270-275. doi: 10.1097/01.bsd.0000203946.11546.d9. PMID: 16778662.
20. Zeinalizadeh, M., et al. "Reduction of Epidural Fibrosis and Dural Adhesions After Lamina Reconstruction by Absorbable Cement: An Experimental Study." *Spine Journal* 14.1 (2014): 113-118. doi: 10.1016/j.spinee.2013.06.065. Epub 2013 Aug 30. PMID: 23999230.