

Evaluating the Frequency of Iatrogenic Dural Tear and Its Complications in Lumbar Spine Surgery

Mohammadreza Moznebiisfahani¹, Ali Foroughi², Saeid Sardarabadi², Mehdi Shafiei^{1*}

¹ Department of Neurosurgery, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

² Isfahan University of Medical Sciences, Isfahan, Iran

*Corresponding Author: Mehdi Shafiei, MD., Department of Neurosurgery, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran. Tel: +989196404694, Email: Mehdishafiei82@gmail.com

Received July 5, 2024; Accepted November 15, 2024; Online Published December 20, 2024

Abstract

Background: Iatrogenic dural tear is a relatively common complication in lumbar spine surgery; however, little information exists about the frequency of this condition and its complications in our country.

Objectives: This study aimed to assess the frequency of dural tear and its complications in lumbar spine surgery.

Methods: This cross-sectional descriptive study was conducted on 884 patients who underwent lumbar spine surgery and were referred to Kashani and Alzahra hospitals from 2020 to 2021. Information including age, gender, type of surgery, duration of surgery, duration of hospitalization, number of hospitalizations, need for a second surgery, number of previous surgeries, complications of surgery, involved vertebrae, and underlying diseases were extracted from the checklist.

Results: Among 884 patients who underwent lumbar spine surgery, iatrogenic dural tear was observed in 62 patients (7%). Fever, headache, and wound site complications were observed in 8 (12.9%), 22 (35.5%), and 4 patients (6.5%), respectively. Moreover, the duration of surgery in the total group and the dural tear group was 195 ± 76.2 and 204.13 ± 71.69 minutes, respectively. The duration of hospitalization in the total group and the dural tear group was 3.10 ± 1.3 and 4.08 ± 2.68 days, respectively. Laminectomy was performed in 24.09% and 24.2% of patients in these two groups, respectively.

Conclusion: According to the findings of this study, the frequency of dural tear was 7%, which may be affected by several factors, including age, duration of surgery and hospitalization, underlying disease, smoking, and history of previous surgery.

Keywords: Complication, Iatrogenic Dural Tear, Lumbar, Dural Repair, Spine Surgery

1. Background

Iatrogenic dural tear is a known complication of lumbar spine surgery.¹ A breach in the integrity of the dural layer can lead to durotomy and CSF leaks.¹ The incidence of dural tear in different studies is 1%-17%.² One of the most effective diagnostic methods is the use of the MRI technique.¹

Several factors, such as the difference in surgical methods, the ossification of the yellow ligament, and severe spinal stenosis increase the risk of iatrogenic dural tear.³⁻⁶ The surgeon experience,⁷ age, and gender also affect iatrogenic dural tear.^{1,3}

The direct effects of dural tear include persistent headache, meningeal pseudocyst formation, wound infection, and wound healing complications. Indirect consequences include prolonged bed rest, which often leads to pressure ulcers, pneumonia, deep vein thrombosis, pulmonary embolism, and aspiration.⁴ Severe problems of dural lacerations include dura-cutaneous fistula,⁷ CSF leak leading to pseudomeningocele, meningitis, arachnoiditis, intracranial subdural hematoma, epidural abscess, nerve root entrapment, and return to the operating room for

closure of the leak.⁷ The majority of these complications have been seen in elective spine surgery in which durotomy occurs iatrogenically. These severe complications may require further surgical intervention.⁸

2. Objectives

Although iatrogenic dural tear is one of the common complications in lumbar spine surgery, there is little information about the frequency of this condition in lumbar spine surgeries as well as its complications in our country. Therefore, this study aimed to assess the frequency of dural tear and its complications in lumbar spine surgery.

3. Methods

This cross-sectional descriptive study was conducted on 884 patients who underwent lumbar spine surgery and were referred to Kashani and Alzahra hospitals from 2020 to 2021. Inclusion criteria included patients undergoing lumbar spine surgeries admitted to Alzahra and Kashani medical centers. Moreover, patients who did not consent to participate in the study or patients with

incomplete medical records were excluded. Data from the checklist were collected by referring to the patient's medical record and through face-to-face visits. The checklist sections included information such as age, gender, type of surgery, duration of surgery, number of hospitalizations, need for a second surgery, duration of hospitalization, number of previous surgeries, complications of surgery, involved vertebrae, and underlying diseases.

3.1. Statistical Analysis

Data were entered into SPSS, version 26. To describe quantitative variables, the mean \pm standard deviation was used. The frequency of patients was shown as a percentage

(%). Statistical analysis was performed using t-tests and chi-square tests.

4. Results

In the current study, among 884 patients who underwent lumbar spine surgery, iatrogenic dural tear was observed in 62 patients (7%). The frequency and mean parameters in patients during lumbar spine surgery are shown in Table 1.

The frequency and mean parameters in patients with a dural tear are shown in Table 2. No significant association was observed between complications and any of the demographic variables.

Table 1. The Frequency and the Mean Parameters in Patients during Lumbar Spine Surgery

Variables	Total (N = 884) N (%)
Gender	
Men	467 (52.8)
Women	417 (47.1)
Type of Surgery	
Laminectomy	213 (24.09)
Discectomy	289 (32.6)
Laminectomy + Discectomy	382 (43.21)
History of Previous Surgery	94 (10.6)
Smoking	188 (21.2)
Underlying Disease	248 (28.05)
Age (years), (mean \pm SD)	46.66 \pm 11.9
Duration of Surgery (min), (mean \pm SD)	195 \pm 76.2
Duration of Hospitalization (day), (mean \pm SD)	3.10 \pm 1.3

SD: Standard Deviation, N: Number

Table 2. The Frequency and the Mean Parameters in patients with Dural Tear

Variables	Patients with dural tear N = 62
Gender	
Men	30 (48.4)
Women	32 (51.6)
Job	
Housewife	20 (32.3)
Employee	15 (24.2)
non-employee	27 (43.5)
Type of surgery	
Discectomy	17 (27.4)
Laminectomy	15 (24.2)
Laminectomy+ Discectomy	30 (48.4)
The number of hospitalizations	
1	59 (95.2)
2	1 (1.6)
3	2 (3.2)
The need to second surgery	
No	60 (96.78)
Yes	2 (3.22)
The number of previous surgeries	
0	48 (77.4)
1	13 (21)
2	1 (1.6)
Fever	
No	54 (87.1)
Yes	8 (12.9)
Wound site complication	
No	58 (93.5)
Yes	4 (6.5)
Smoking	
No	48 (77.4)
Yes	14 (22.6)
Headache	
No	40 (64.5)
Yes	22 (35.5)
Underlying disease	
No	43 (69.4)
Yes	19 (30.6)
Involved vertebrae (T12)	
No	61 (98.4)
Yes	1 (1.6)

Involved vertebrae (L1)	
No	56 (90.3)
Yes	6 (9.7)
Involved vertebrae (L2)	
No	53 (85.5)
Yes	9 (14.5)
Involved vertebrae (L3)	
No	47 (75.8)
Yes	15 (24.2)
Involved vertebrae (L4)	
No	36 (58.1)
Yes	26 (41.9)
Involved vertebrae (L5)	
No	33 (53.2)
Yes	29 (46.8)
Involved vertebrae (S1)	
No	47 (75.8)
Yes	15 (24.2)
Age (years), (mean \pm SD)	48.12 \pm 12.9
Duration of surgery (min), (mean \pm SD)	204.13 \pm 71.69
Duration of hospitalization (day), (mean \pm SD)	4.08 \pm 2.68
BMI (kg/m ²), (mean \pm SD)	25.19 \pm 2.1

5. Discussion

In the current study, among 884 patients who underwent lumbar spine surgery, iatrogenic dural tear was observed in 62 patients (7%). Yoshihara et al. investigated the frequency of iatrogenic dural tear in lumbar spine surgery and reported it to be 2.7%.³ Smorgick et al. conducted a study in this regard and observed that the incidence of iatrogenic dural tear was 4.6%.⁹ Muller et al. reported that the rate of dural tears in spinal surgery was 2.7%, with a range from 0% to 8.6%.⁸ According to these findings, the frequency of dural tear in various studies was different. Different factors may play a role. In the current study, the mean age of patients with a dural tear was greater than the general population. Mueller et al. also achieved the same result and reported that the mean age of patients with a dural tear was significantly greater than the patients without a dural tear.⁸ Yoshihara et al. reported that the dura in elderly patients may tend to have a more friable appearance, which may predispose it to tear.³ The incidence of dural tear was also affected by the experience level of the surgeon.^{10,6} Blecher et al. also reported that a decreased experience level of the surgeon increases the risk of dural tear.¹¹

Moreover, the incidence of dural tear was seen in 7.60% of women and 6.4% of men. Other studies achieved the same result and reported that this incidence in women was higher than in men,^{3,8} indicating that gender can affect dural tear in patients undergoing lumbar spine surgery. Another parameter that may affect dural tear is the type of surgery. In the current study, laminectomy was performed in 24.1% of cases of dural tear. Additionally, a laminectomy was performed in 24.09% of total cases. Also, dural tearing was seen in 7% of laminectomy cases and 5.8% of discectomy cases. Smorgick et al. assessed the predisposing factors of dural tear in patients undergoing lumbar surgery and reported that the incidence of dural tear was higher in patients who underwent laminectomy.⁹ The findings of this study were not inconsistent with our study. Therefore, it appears that

various parameters are involved in dural tear.

The history of previous surgery in patients with iatrogenic dural tear was 22.6% and 10.6% in total cases. Smorgick et al. investigated the frequency of iatrogenic dural tear in patients undergoing spinal surgery and reported that this frequency in patients without a history of surgery was 7.2% and in patients with a history of previous spine surgery was 10.5%, indicating that the incidence of dural tear was more common in patients with a history of previous spine surgery.⁹ Thomsen et al. also reported that the incidence of dural tear was doubled in the second surgery.¹² Moreover, longer surgery was another parameter that affects dural tear. In the current study, the duration of surgery in patients with and without dural tear during lumbar spine surgery was 204.13 \pm 71.69 and 195 \pm 76.2 minutes, respectively. Smorgick et al. reported that patients with incidental durotomy had longer surgery (146 \pm 59 minutes) than the patients without dural tear (110 \pm 54 minutes).⁹ Furthermore, the mean duration of hospitalization was 4.08 \pm 2.68 days. Guerin et al. also reported that the mean duration of bed rest was 2.68 days.¹³ Wang et al. demonstrated that the mean bed rest in patients was 2.9 days.¹⁵ Yoshihara et al. demonstrated that patients with dural tear require more care after discharge. In addition, along with a longer hospital stay, the mean total costs and the economic burden were also significantly higher in patients with dural tear than those without a dural tear.³ Furthermore, it seems that longer operative time and longer postoperative bed rest duration can be related to the higher incidence of unrelated complications in patients with a dural tear.¹⁴ Muller et al. reported that prolonged postoperative bed rest has no additional benefit for patients and may even lead to greater complications associated with immobilization.⁸

It is also known that diabetes and smoking can negatively affect the outcome of surgery and lead to disorders of wound healing, surgical site infection, and more re-operations.¹⁶ In the current study, underlying diseases and smoking were observed in 30.6% and 22.6%

of patients, respectively. However, studies regarding the effect of diabetes and smoking on the rate of dural tears are rare.¹⁶ In the current study, wound site complications were observed in 6.5% of patients. Moreover, fever was seen in 12.9% of patients. Puvanesarajah et al. also reported that the occurrence of a dural tear was associated with wound infection in elderly individuals who underwent primary lumbar discectomy.¹⁷ Ahn et al. reported that among 9 patients with a dural tear, headache with back pain as the CSF leakage occurred in 3 patients.¹⁸ Takenaka et al. reported that surgery-related complications such as surgical site infection and postoperative neurological deficit were more likely to happen in the dural tear group than in the non-dural tear group.¹⁴ Yoshihara et al. assessed patient outcomes following spine surgery and compared the rate of hospital complications in the dural tear group to the non-dural tear group. They showed that the frequency of wound-related complications in the dural tear group was 3.5% compared to 2.0% in the non-dural tear group. Additionally, the rates of neurologic events in these groups were 3.4% and 0.9%, respectively.³ Adogwa et al. reported no significant difference between patients with incidental durotomy and the control group in terms of postoperative infections requiring re-operation.¹⁹ Therefore, there were contradictory findings in this regard.

In addition, a second surgery was observed in 3.2% of patients. Wolf et al. assessed surgical dural tears in 1359 patients and found that none of the patients required a second surgery.²⁰ Mustafa et al. evaluated dural tears during lumbar spine surgery and reported that 1.8% of patients needed a second surgery.²¹ Therefore, since no comprehensive study has been conducted on the need for a second surgery in our country, it is recommended to conduct further studies in this area. The limitations of this study include its retrospective nature and the lack of access to some patient data.

6. Conclusion

According to the findings of this study, the frequency of dural tears was 7%, which may be affected by several factors, including age, type of surgery, underlying disease, and history of previous surgery. Dural tearing also affected the duration of hospitalization.

Research Highlights

What Is Already Known?

Iatrogenic dural tear is a relatively common complication in lumbar spine surgery, with little information available about its frequency and complications.

What Does This Study Add?

Dural tears can be affected by various factors, including age, duration of surgery and hospitalization, underlying disease, smoking, and previous surgical history. However, complications from dural tears are not affected by patient demographic factors.

Author Contributions

Authors contributed equally to this work.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

Ethical Approval

After obtaining written consent from patients, the current study was approved by the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1400.165).

References

- Shah KC, Kothari MK, Nene A. Incidental Dural Tears during Spine Surgery: Prevention and Management. *J Orthop Complicat.* 2016;1(1):23-5.
- Eldin MM, Razek NM. Epidural fibrosis after lumbar disc surgery: prevention and outcome evaluation. *Asian Spine J.* 2015;9(3):370-85. doi:10.4184/asj.2015.9.3.370
- Yoshihara H, Yoneoka D. Incidental dural tear in spine surgery: analysis of a nationwide database. *Eur Spine J.* 2014;23:389-94. doi:10.1007/s00586-013-3091-z
- Takahashi Y, Sato T, Hyodo H, Kawamata T, Takahashi E, Miyatake N, et al. Incidental durotomy during lumbar spine surgery: risk factors and anatomic locations. *J Neurosurg Spine.* 2013;18(2):165-9. doi:10.3171/2012.10.SPINE12271
- Hannallah D, Lee J, Khan M, Donaldson WF, Kang JD. Cerebrospinal fluid leaks following cervical spine surgery. *J Bone Joint Surg.* 2008;90(5):1101-5. doi:10.2106/JBJS.F.01114
- Pechlivanis I, Kuebler M, Harders A, Schmieder K. Perioperative complication rate of lumbar disc microsurgery depending on the surgeon's level of training. *Cent Eur Neurosurg.* 2009;70(3):137-42. doi:10.1055/s-0029-1216361
- Luszczyc MJ, Blaisdell GY, Wiater BP, Bellabarba C, Chapman JR, Agel JA, et al. Traumatic dural tears: what do we know and are they a problem?. *Spine J.* 2014;14(1):49-56. doi:10.1016/j.spinee.2013.03.049
- Müller SJ, Burkhardt BW, Oertel JM. Management of dural tears in endoscopic lumbar spinal surgery: a review of the literature. *World Neurosurg.* 2018;119:494-9. doi:10.1016/j.wneu.2018.05.251
- Smorgick Y, Baker KC, Herkowitz H, Montgomery D, Badve SA, Bachison C, et al. Predisposing factors for dural tear in patients undergoing lumbar spine surgery. *J Neurosurg Spine.* 2015;22(5):483-6. doi:10.3171/2015.1.SPINE13864
- Baker GA, Cizik AM, Bransford RJ, Bellabarba C, Konodi MA, Chapman JR, et al. Risk factors for unintended durotomy during spine surgery: a multivariate analysis. *Spine J.* 2012;12(2):121-6.
- Blecher R, Anekstein Y, Mirovsky Y. Incidental dural tears during lumbar spine surgery: a retrospective case study of 84 degenerative lumbar spine patients. *Asian Spine J.* 2014;8(5):639-45. doi:10.4184/asj.2014.8.5.639
- Thomsen F, Amtoft O, Andersen M, Bøge-Rasmussen T, Jensen TT, Jensen LE, et al. Iatrogenic dural lesions in lumbar neural decompressive surgery. *Ugeskrift for læger.* 2010;172(9):688-91.
- Guerin P, El Fegoun AB, Obeid I, Gille O, Lelong L, Luc S, et al. Incidental durotomy during spine surgery: incidence, management and complications. A retrospective review. *Injury.* 2012;43(4):397-401. doi:10.1016/j.injury.2010.12.014
- Takenaka S, Makino T, Sakai Y, Kashii M, Iwasaki M, Yoshikawa H, et al. Dural tear is associated with an

- increased rate of other perioperative complications in primary lumbar spine surgery for degenerative diseases. *Medicine*. 2019;98(1):e13970. doi:10.1097/MD.00000000000013970
15. Wang JC, Bohlman HH, Riew KD. Dural tears secondary to operations on the lumbar spine. Management and results after a two-year-minimum follow-up of eighty-eight patients. *J Bone Joint Surg*. 1998;80(12):1728-32.
 16. Aspalter S, Senker W, Radl C, Aichholzer M, Aufschneider-Hießböck K, Leitner C, et al. Accidental dural tears in minimally invasive spinal surgery for degenerative lumbar spine disease. *Front Surg*. 2021;8:708243. doi:10.3389/fsurg.2021.708243
 17. Puvanesarajah V, Hassanzadeh H. The true cost of a dural tear: medical and economic ramifications of incidental durotomy during lumbar discectomy in elderly Medicare beneficiaries. *Spine*. 2017;42(10):770-6. doi:10.1097/BRS.0000000000001895
 18. Ahn Y, Lee HY, Lee SH, Lee JH. Dural tears in percutaneous endoscopic lumbar discectomy. *Eur Spine J*. 2011;20:58-64. doi:10.1007/s00586-010-1493-8
 19. Adogwa O, Huang MI, Thompson PM, Darlington T, Cheng JS, Gokaslan ZL, et al. No difference in postoperative complications, pain, and functional outcomes up to 2 years after incidental durotomy in lumbar spinal fusion: a prospective, multi-institutional, propensity-matched analysis of 1,741 patients. *Spine J*. 2014;14(9):1828-34. doi:10.1016/j.spinee.2013.10.023
 20. Wolff S, Kheirredine W, Riouallon G. Surgical dural tears: prevalence and updated management protocol based on 1359 lumbar vertebra interventions. *Orthop Traumatol Surg Res*. 2012;98(8):879-86. doi:10.1016/j.otsr.2012.06.016
 21. Khan MH, Rihn J, Steele G, Davis R, Donaldson III WF, Kang JD, et al. Postoperative management protocol for incidental dural tears during degenerative lumbar spine surgery: a review of 3,183 consecutive degenerative lumbar cases. *Spine*. 2006;31(22):2609-13. doi:10.1097/01.brs.0000241066.55849.41