

Incidence and Outcomes of Dural Tear in Open Versus Microscopic Single Level Lumbar Discectomy

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Abstract

Background: Incidental durotomy is a common complication of lumbar spine surgery. It is more common in complicated pathologies and recurrent cases.

Aim of Study: To compare the incidence and outcome of dural tears in open and microscopic single level lumbar discectomy.

Patients and Methods: A retrospective analysis of the data of 40 patients divided into 2 groups was done. Group A contained open discectomy cases and group B contained microscopic discectomy cases.

Results: The incidence of dural tears was lower in the microscopic group, however, the correlation was not statistically significant. Additionally, the microscopic group had a significantly shorter hospital stay and faster return to work. Dural tears were also found to significantly prolong hospital stay in both groups.

Conclusion: Microscopic minimally invasive lumbar discectomy could provide a lower incidence of dural tear and a better outcome for patients undergoing single level lumbar discectomy. However, further studies are required to verify the statistical significance of the acquired data.

Key Words: Lumbar — Minimally invasive — Microscopic discectomy — Dural tear.

Introduction

INCIDENTAL dural tears remain a fairly common complication of lumbar spine surgeries with an incidence up to 15.8%. Some studies report an even higher incidence. The incidence is higher with more complicated surgeries including multilevel lumbar pathologies and tight lumbar canals [1-4].

Minimally invasive spine surgery has several advantages including minimal surgical manipulation of the back musculature and providing faster recovery [5].

The potential benefits regarding the incidence of dural tear in lumbar discectomy surgery when compared to conventional open surgery have not been thoroughly investigated, specifically in cases requiring only single level lumbar discectomies [6].

Microscopic magnification allows for better visualization of the dura and better dissection of overlying ligaments and any adhesions. Additionally, single level microscopic discectomy is associated with a minimal dead space, potentially lowering the incidence of post-operative cerebrospinal fluid (CSF) collections and CSF leakage [5,7].

Thus, microscopic lumbar discectomy could possibly provide a lower incidence of incidental dural tears and their associated complications, in addition to the already established advantages of minimal manipulation and faster recovery after lumbar disc surgery [2,6].

The aim of this study:

Is to compare the incidence and outcome of dural tear in single level open lumbar discectomy versus microscopic discectomy.

Patients and Methods

Study design:

A retrospective study comparing the incidence and outcomes of dural tear in single level lumbar discectomy in open versus microscopic approach. Patients were divided into two groups: Group A included cases operated upon by open lumbar discectomy and Group B included cases operated upon by microscopic lumbar discectomy.

Inclusion criteria:

- Patients requiring surgery for a single level lumbar disc prolapse after failure of conservative management.

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- Cases operated upon at Kasr Al-Ainy, Cairo University Hospitals between January and December 2022, with complete medical records.

Exclusion criteria:

- Recurrent cases.
- Cases requiring more than one level surgery.
- Cases requiring lumbar fixation.

Retrospective data analysis was performed for 40 cases divided into 2 groups. Group A included 20 patients operated upon by open surgery Group B included 20 patients operated upon by minimally invasive microscopic discectomy. The collected data was analyzed for correlation between the type of surgery performed, the incidence of incidental dural tear and the outcome.

Group A (20 cases) were operated upon by conventional open lumbar discectomy, where full laminectomy was performed to visualize the herniated lumbar disc. The herniated disc was removed, and lumbar nerve root decompression was performed for all cases. No drains were used in any of the cases. Dural tears were managed by primary repair whenever possible followed by application of a small piece of flattened muscle on lay over the site of the tear with an overlying piece of gel foam followed by watertight closure of the fascia.

Group B (20 cases) were operated upon by microscopic lumbar discectomy, where only a unilateral laminotomy was performed as needed to visualize the herniated lumbar disc. The herniated disc was removed, and the affected lumbar nerve root was decompressed for all cases. No drains were used in any of the cases. A single case had a dural tear, that was managed by placement of a flattened piece of muscle on lay over the tear and an overlying piece of gel foam followed by watertight closure of the fascia.

Full peri-operative records were collected including demographic patient data, operative data including operative time, blood loss and the incidence of dural tears. Post-operative data included the incidence and management of complications, hospital stay and the time till return to work.

Statistical analysis:

SPSS (statistical package for social sciences) will be used for data management and data analysis. Mean \pm standard deviation described quantitative variables and median with range when appropriate (distribution deviated from normality).

Number and percentages described qualitative data and Chi-square or / Fisher exact tested proportion independence. For comparing mean values of two independent groups, parametric or non-parametric t-tests were used. For comparing mean values of more than two groups, one way ANOVA test was used. A post-hoc Turkey Honest Significant Different (HSD) test was done if ANOVA test showed an overall significant difference between the groups to determine where the significance lies. Differences were considered significant if p-value was less than 0.05.

Results

We reviewed data obtained from medical records of 40 patients, surgically treated for single level lumbar disc prolapse. Cases were divided into two equal groups of twenty patients.

Group A contained patients treated with conventional open discectomy, while Group B patients were treated with microscopic discectomy.

The mean age of our study group was 38.63 ± 13.83 years, with ages ranging from 18 to 66 years. Twenty patients were males and twenty females. Associated co-morbidities included hypertension in five patients and diabetes mellitus in six patients. The duration of symptoms was largely variable ranging from one week to 4 years with a mean duration of 19.26 ± 17.11 months. L4-5 and L5-S1 lumbar disc prolapse had the highest incidence among our patients 37.5% each, while L1-2 lumbar disc prolapse was found in only two cases (5%) (Table 1). There was no significant association between the level of the disc prolapse and the incidence of dural tears. The mean duration of surgery was similar in cases of microscopic discectomy (104 ± 37 minutes) compared to open discectomy (101 ± 31 minutes), with the difference being non statistically significant $p=0.783$. The mean surgical blood loss was not significantly different, 177 ± 88 ml in open cases and 135 ± 75 ml in microscopic cases $p=0.108$.

Table (1): Levels of disc prolapse in the study group.

	Frequency	Percent	Vaild percent	Cumulative percent
<i>Vaild:</i>				
L1-2	2	5.0	5.0	5.0
L2-3	1	2.5	2.5	7.5
L3-4	7	17.5	17.5	25.0
L4-5	15	37.5	37.5	62.5
L5-S1	15	37.5	37.5	100.0
Total	40	100.0		

The incidence of dural tears was higher in the open discectomy group 20% (4 cases), compared to the microdiscectomy group 5% (1 case), however the difference was not statistically significant $p=0.159$ (Table 2). One case from the open discectomy group developed a pseudomeningocele followed by CSF leak and was managed by a lumbar drain insertion, however, the case ultimately required repair surgery. One more case from the open discectomy group developed CSF leak, a lumbar drain was inserted, and the leak stopped with no further intervention needed. The single case with dural tear in the microdiscectomy group did not develop any collection or CSF leak. None of our cases were complicated by infection.

Table (2): Correlation between the type of surgery and development of dural tears.

	Type of surgery	Dural tear
<i>Type of surgery:</i>		
Pearson correlation	1.000	-.227
Sig. (2 - tailed)		.159
N	40	40
<i>Dural tear:</i>		
Pearson correlation	-.227	1.000
Sig. (2 - tailed)	0.159	
N	40	40

The mean hospital stay was 1.25 ± 1.13 days (2 ± 2 days in open cases and 1 day in microscopic cases). Patients returned to work significantly faster after microscopic discectomy (22 ± 7 days) when compared to open cases (30 ± 17 days) $p=0.044$. The incidence of dural tears in both groups combined was associated with a significantly longer hospital stay $p<0.001$ (Table 3).

Table (3): Correlation between the incidence of dural tears and hospital stay.

	Dural tear	Hospital stay (days)
<i>Dural tear:</i>		
Pearson correlation	1.000	.595a
Sig. (2 - tailed)		.000
N	40	40
<i>Hospital stay (days):</i>		
Pearson correlation	.595a	1.000
Sig. (2 - tailed)	.000	
N	40	40

a: Significant at 0.05 level.

Discussion

Incidental durotomy is an undesirable yet relatively common complication of lumbar spine surgery [8,9]. Incidence is typically higher in recurrent surgeries, however, the incidence maybe lower in less complicated single level lumbar discectomy [2,8,9]•

The introduction of minimally invasive spine surgery provided many benefits especially in single level lumbar discectomies, where patients experience a shorter hospital stay and a faster recovery [5].

Additional benefits are achieved when adding microscopic magnification that provides better visualization of the neural structures and allows for fine handling of delicate tissues [5].

Our study aimed to assess the possible benefits of microscopic surgery regarding the incidence and outcome of dural tears in single level lumbar discectomy, when compared to conventional open surgery.

We conducted a retrospective analysis of data obtained from the medical records of forty patients operated upon by single level lumbar discectomy. Patients were divided into two groups, each group containing twenty patients. Group A were patients who underwent open lumbar discectomy, while Group B were patients who had microscopic lumbar discectomy.

Relevant demographics showed no significant difference between the two study groups. Male patients were equal to females with a mean age of 38.63 ± 13.83 years.

Associated patient co-morbidities particularly diabetes and hypertension were not associated with a significant impact on the incidence of dural tears or other complications.

The duration of pre-operative symptoms was similar among the study groups and the affected lumbar disc level was L4-5 and L5-S1 disc levels in both groups. However, no significant correlation could be achieved between the level of disc prolapse and the incidence of dural tears.

Microscopic surgery has a learning curve requiring special training after which operative times become comparable to open surgery. The mean duration of surgery in all patients was 102 ± 33.83 minutes, which was similar in both groups. Operative blood loss was slightly lower in microscopic cases 135 ± 75 ml $p=0.108$. This can be attributed to the smaller wound and less tissue damage.

The total incidence of dural tears was 12.5% which is consistent with reported literature. However, the incidence in the open group was 20% compared to only 5% in the microscopic group $p=0.159$. CSF leak was also only found in two of the open group patients, one of them requiring a repair surgery after failure of conservative management. The single microscopic case with dural tear was not complicated by any collection or leakage of CSF, which can be attributed to the very little dead space left in such cases. The superior illumination and magnification of the operating microscope may explain the slightly better results. However, more cases would be needed to achieve a statistically significant conclusion.

Sharma and his colleagues reported a significantly lower incidence of dural tears and earlier return to work among their study of 420 patients [6].

Hospital stay and time to return to work were significantly shorter in the microscopic surgery group ($p<0.001$ and $p=0.004$ respectively). This is consistent with various literature reports and provided the foundation of the recent shift towards minimally invasive procedures [5,7].

Dural tears were associated with a significantly longer hospital stay $p<0.001$. Erdogan and his colleagues reported a statistically significant prolongation of hospital stay in patients who developed dural tears as a part of their large study group [9].

Conclusion:

Minimally invasive spine surgery is gradually gaining advocates among spine surgeons, with various benefits being reported in literature and many more benefits being continuously established.

Microscopic discectomy especially in single level procedures appears to provide a good outcome in cases complicated by incidental durotomy. However, the number of our cases were not sufficient to provide statistically significant data. Further larger studies may help prove this theorized benefit.

However, the continuously proven benefits of minimally invasive surgery provide a good foundation to explore more expected yet still unproven benefits of this type of surgery.

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معدل حدوث ونتائج تمزق الأم الجافية فى جراحة استئصال الغضروف القطنى المفتوحة على مستوى واحد مقارنة بالجراحة الميكروسكوبية

يعتبر تمزق الأم الجافية أحد المضاعفات الشائعة لجراحات العمود الفقرى القطنى، لا سيما فى الحالات الجراحية المعقدة وفى الجراحات المرتجعة.

تهدف هذه الدراسة مقارنة معدل حدوث ونتائج تمزق الأم الجافية فى جراحة استئصال الغضروف القطنى المفتوحة على مستوى واحد بالجراحة الميكروسكوبية.

تم دراسة الملفات الطبية الخاصة بأربعين حالة جراحية مقسمة إلى مجموعتين. مجموعة أ تشمل حالات الجراحة المفتوحة ومجموعة ب تشمل حالات الجراحة الميكروسكوبية.

أظهرت النتائج انخفاض معدل حدوث تمزق الأم الجافية فى الجراحة الميكروسكوبية، ولكن لم تكن النتائج ذات دلالة إحصائية. كذلك تمتعت حالات الجراحة الميكروسكوبية بإقامة أقصر داخل المستشفى مع القدرة على العودة للعمل بصورة أسرع مقارنة بالجراحة المفتوحة. كما وجد أن حدوث تمزق الأم الجافية يتسبب فى إطالة مدة البقاء بالمستشفى بصورة بارزة فى المجموعتين الجراحتين.

تتيح الجراحة الميكروسكوبية ذات التدخل المحدود لاستئصال الغضروف القطنى المنزلق على مستوى واحد معدل منخفض لحدوث تمزق الأم الجافية ونتائج أفضل مقارنة بالجراحة المفتوحة. ولكن تحتاج النتائج لمزيد من الأبحاث لتأكيد دلالتها الإحصائية.