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Incidental Durotomy in Lumbar Spine Surgery: Incidence, Risk Factors And Management

Mohamed Nosseir, MD

Department of Neurosurgery, Ain Shams University, Cairo, Egypt.

Abstract

Background Data: Incidental durotomy is a common complication of lumbar spine operations for degenerative disorders. Its incidence changes depending on a few risk factors.

Purpose: Our study aims to estimate the incidence of unintentional durotomy during operations for degenerative lumbar spinal disorders, risk factors as well as the intraoperative and postoperative management of this complication.

Patient Sample: Over a 3 years period from January 2011 and December 2013, 630 patients were operated on for degenerative lumbar disorders in our department of neurosurgery. They were clinically followed up for about 24 months.

Method: The surgical approaches for primary operations included uni-lateral fenestration, bi-lateral fenestration, hemilaminectomy and laminectomy. The surgeries were performed by different neurosurgeons with different professional degree and operative experience. For patients with canal stenosis, the surgical approaches included bi-lateral fenestration and laminectomy. With regards to recurrent cases, we remove the compressive element, whether it is the epidural scar or the disc fragment.

Results: During the study period, 432 patients (68.6%) were operated on for lumbar disc herniation, 172 patients (27.3%) were operated on for lumbar spinal stenosis and 26 patients (4.1%) were operated on for recurrent cases. Incidental durotomy occurred in 30 cases, resulting in an overall incidence rate of 4.76%.

Unintentional durotomy occurred in 10 (33.33%) of the patients with herniated disc, in 9 (30%) of the patients with lumbar spinal stenosis and in 11 (36.67%) of the patients who were operated on for recurrences. The most common risk factors were: obesity, recurrence and the physician's surgical experience. Intraoperative dural fissures were repaired through suture, by applying muscle or fat graft. Two CSF fistulas existed and repaired during reoperation.

Conclusion: Incidental dural fissures during operations for degenerative lumbar disorders should be recognized and immediately fixed to avoid complications such as CSF fistula, osteodiscitis and increased medical costs. Preventing, identifying and managing unintentional durotomies can be optimally achieved by applying and respecting efficient surgical techniques and a standardized treatment protocol. (2014EJ067)

Key Words: Durotomy, Lumbar spinal surgery

Introduction

Incidental injury of lumbar dura during surgery for lumbar herniated disc or lumbar spinal stenosis is a serious complication which needs to be identified and immediately repaired to prevent further complications.[9,12,20] CSF fistula is one of the most common type of complications and its occurrence increases the hospitalization period of the patient as well as the costs of a new surgical intervention.[12,21]

The incidence of unintentional durotomy during spinal operations is anticipated to be between 1.6-17.4%, depending on the type (primary or recurrent) and complexity of the surgery, the surgeon's experience and the patient's age.[1,2,6,9,13,15,19]

The main risk factors of our study are obesity and surgical experience; our study also aims to estimate the incidence of unintentional durotomy during operations for degenerative lumbar spinal disorders as well as the intraoperative and postoperative management of this complication.

Materials and Methods

Patient Population:

A retrospective study (descriptive cohort[5]) was conducted on clinical and surgical records and radiographic data for successive patients (630 patients) who experienced spinal surgery at the Neurosurgery Department, Ain Shams University from January 2011 to December 2013, a period of three years.

In all cases the symptoms persisted for more than 8 weeks with no response to conservative therapy.

Operation:

The primary surgery for lumbar disc herniation consisted of uni-lateral or bi-lateral fenestration or hemi-laminectomy followed by discectomy. For lumbar spinal stenosis, we performed bi-lateral fenestration in cases of foraminal stenosis and laminectomy in cases of central stenosis.

In recurrent cases, we tried to identify normal dura at the extremities of fenestration or laminectomy. We then removed the compressive element, whether it was the epidural scar or the disc fragment.

When we were faced with incidental durotomy, we tried to close the dural breach by primary suture if possible with 4-0 vicryl. The suture was covered with fat graft or muscle graft and gel foam. In other cases, the dural breach was small or lateral that the suture was unnecessary or impossible. In these cases we applied muscle graft, fat graft and then a layer of gel foam. In some cases, we used subfascial drains. (Figure 1)

Post-operative:

Patients received antibiotics (ceftazidime) for 5 days and they stayed in bed for 3-4 days, based on the length of durotomy and the quality of dural repair.

Results

Through the study period, 630 patients were operated on for lumbar degenerative diseases, during which incidental durotomy occurred in 30 cases, resulting in an overall incidence rate of 4.76%.

Sociodemographic characteristics: The mean age ± standard deviation was 40±9.6 years [16-72]. There were 353 females (56%) and 277 males (44%). Abnormal body mass (BMI≥25Kg/m²) occurred in 20 patients 68.3%.

The commonest age for the incidence of Incidental durotomy was between 31 and 72, with a peak in their sixties, as this is the age of appearance and surgical intervention on herniated disc, canal stenosis and recurrent cases. The main risk factor amongst the comorbidities was obesity, which was detected in 20 cases (68.3%)(Table 3).

According to the surgical experience of the surgeons (Table 4); the incidence of durotomy was highest with the novice (7.1%). There was no statistically significant difference in durotomy rate with experts (P>0.05) however there was an absolute difference with more durotomies with the intermediate surgeons.

Incidental durotomy most commonly exists in the L4-L5 level, because this is the most common site for lumbar disc herniation (Table 1). Incidental durotomy occurred more frequently in recurrent cases (26.92 %), compared to primary operations for herniated disc (2.31%) or spinal stenosis (4.07%). It is more frequent in recurrences as many of these cases were operated for herniated disc many years ago using laminectomy performed at 1 or 2 levels. The postoperative scar was extensive and adherent. The reoperation was performed for recurrent cases at the same level or at adjacent levels, to remove the fragment of the herniated disc and epidural scar.

The most common locations of the dural injury were the lateral lesions [22 cases (73.33%)], followed by injury of the root sheath (10%) and axilla (10%). The anterior dural injury occurred in only

2 cases. One was caused by completely expelled intervertebral disc in the spinal canal, which was not recognized intraoperatively and the other by caudally migrating disc in the axilla.

Primary dural repair was made by suturing the dura; followed by applying a layer of muscle or fat graft and a layer of gel foam in 7 cases (23.33%). In the other 23 cases (76.67%), we applied a layer of muscle or fat graft and a layer of gel foam only.

The epidural drain was used in 7 cases, in other cases epidural bleeding formed a layer and was considered to promote healing of the dura. In these cases, we did good haemostasis of the muscle and fascia. Patients with intraoperative CSF leak remained at bed rest for 3-4 days, during this period and to prevent infection, they received antibiotics for 5 days.

In 1 of the 2 cases of the CSF fistula; the dural leak was not recognized intraoperatively during the primary surgery. In the 2 cases, the repair was performed during re-intervention by dural suture and fat graft.

Osteodiscitis occurred in 1 case with dural leak; who had an epidural drain after surgery. Orthostatic Headache occurred in 2 cases; which were managed by Intravenous fluids and bed rest. Another postoperative complication was wound dehiscence, which appeared when the stitches had been removed in 1 case. There was one case of meningocele which needed re-operation for secondary repair.

Table 1: Patients' Clinical, Operative and Post-Operative Data

Disease	Number	%
Lumbar Disc Herniation (without spinal stenosis)	432	68.57
Spinal Stenosis (with or without lumbar disc herniation)	175	27.78
Reoperation For Recurrence	29	4.60
Level of Durotomy		
L3-L4	2	6.67
L4-L5	14	46.67
L5-S1	11	36.67
2 levels	2	6.67
3 levels	1	3.33
Type of Operation:		
Unilateral fenestration	18	60.00
Bilateral fenestration	4	13.33
Hemilaminectomy	3	10.00
Laminectomy	5	16.67
Durotomy and Type of Pathology:		
Disc herniation	10	33.33
Spinal stenosis	9	30.00
Reoperation	11	36.67
Site of Dural Lesion		
Lateral	22	73.33
Anterior	2	6.67
Root sheath	3	10
Root axilla	3	10
Epidural Drain		
With drain	10	33.33
Without drain	20	66.67

Table 2: Complications of Durotomy

Complications of Durotomy	Number	%
CSF fistula	2	6.67
Osteodiscitis	1	3.33
Headache	2	6.67
Wound dehiscence	1	3.33
Meningocele	1	3.33
TOTAL	7	23.33

Table 3: Risk Factors for Durotomy-Obesity

Variable	Patients	Mean±SD	Min	Max
Body Mass Index	N=30	27.8±4.9	19.5	45.4
BMI Male	N=14	26.4±3.8	19.5	39.8
BMI Female	N=16	30.4±5.8	19.5	45.4
BMI and Durotomy	N=30	Frequency (%)		
Obesity (BMI≥25Kg/m²)	N=20	68.3		
Normal (BMI<25Kg/m²)	N=10	31.7		

Table 4: Risk Factors for Durotomy-Surgical Experience

	Durotomy	No Durotomy	**Total	Incidence	P-Value
Expert	(5.7) 4	(94.3) 66	70	5.7%	
Intermediate	(3.8) 16	(96.2) 404	420	3.8%	P1=0.45
Novice	(7.1) 10	(9.3) 130	140	7.1%	P2=0.69
Total	30	600	630	4.76%	

Expert= 10 or more years of experience (lecturers and professors)
Intermediate=4-10 years of experience (assistant lecturers)
Novice= Less than 4 years (Senior Resident
P1= P-value comparing intermediate and expert (RR=0.67)
P2= P-value comparing novice and expert (RR=1.3)
P3= P-value comparing the intermediate and novice=0.01 (RR=1.9)
**estimates from 2011 data (ratio of surgeries disc surgeries of expert: intermediate: novice=1:6:2)
RR= Relative Risk of durotomy

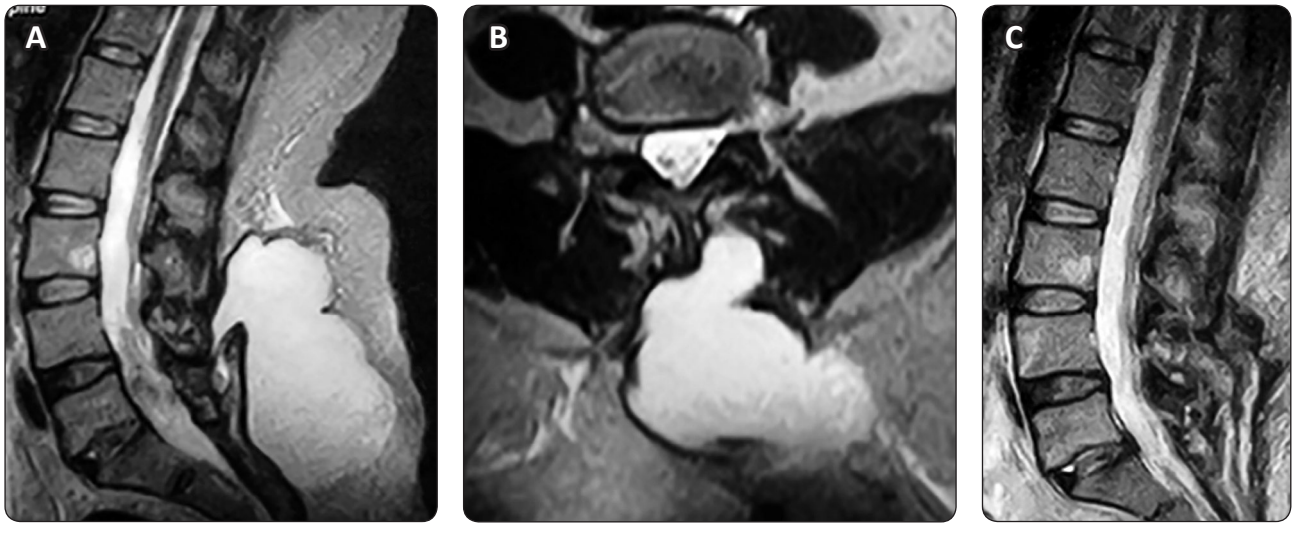

Figure 1: Forty-year-old female patient with post-operative T2 sagittal (A) and axial (B) MRI demonstrating CSF fistula and pseudomeningocoele, (C) post repairs sagittal T2 MRI of the same case.

Discussion

Incidental durotomy is a very common complication of spinal surgery, even between surgeons with high professional qualification. It has been reported in several series of patients operated for degenerative spinal injuries.[1]

Incidental durotomy rates vary widely in literatures. The prevalence rate of incidental durotomy is 1%-17.4%. The incidence of dural tears is variable according to indications, to the type of procedures and to the different studie.[1,2,6,9,13,15,18,19] This study reports an incidence rate of 4.76%, which is closer to the lower limit of the incidence reported by current literatures.[1]

Non-operative treatment of durotomies is not successful and should be treated intraoperatively. Ideally, primary repair of dural tears should be done and is successful in most cases.[4,6,17] A valsalva maneuver is recommended to check for completeness of repair. This maneuver increases the intrathecal pressure and will identify incompletely repaired dural tear as made evident by CSF leaking through the repaired defect. A tight fascial layer closure is necessary to provide an essential barrier to cerebrospinal fluid egress and infection.[4,6,7,9,15,16]

Irregular bone surfaces in our approaches could explain the occurrence of CSF fistula in cases when intraoperative was not notified any dural break and the dura was thin and translucent.

Durotomies occurred more frequently within patients in the sixth decade of life. Unlike supporting studies such as Williams et al, [15] we cannot support an increased incidence in relation to age. The sixth decade of life is the period with the most frequently occurring herniated disc.[1]

Prevention is the most effective way to reduce the prevalence of CSF leak. Preoperative planning and meticulous surgical technique are important to reduce the incidence of durotomies. Obesity was the major risk factor as well as surgical experience (Table 4).

We confirm that there is a significantly higher incidence of unintentional durotomy in operations for recurrent disc herniations. The high incidence in revision operations can be explained through the fact that, previously, the approach used for disc herniations was laminectomy, which resulted in an extensive epidural scar at the level of the dura and the nerve roots. [3,8,13,16] We aimed to remove the epidural scar and the disc herniation. If the dissection in the epidural space is lateral, at the level of the herniated disc, leaving scar on the posterior dural sac, the incidence rate of unintentional durotomy decreases.[1]

In our study, durotomy was not associated with damage to the spinal nerves and has not created new neurological deficits postoperatively. Wang et al, [13] Jones et al, [8] Cammisa et al[2] reached similar conclusions: dural tears do not have deleterious effects in outcomes, do not increase the risk of other perioperative morbidities or later outcome.[18] Saxler et al,[10] had different results: in his group of 41 lumbar discectomy patients with intraoperative durotomies, they presented a poorer outcome after surgery.

The use of drains is controversial. Eismont et al,[4] advised against placement of subfascial drains because it could precipitate the formation of a durocutaneous fistula. Cammisa et al.[2] reported their use of drain is dependent on the procedure, the size of the dural tear, the tissue quality and the quality of the repair. Wang et al,[13] placed a drain in all cases. They found that subfascial drains did not lead to the formation of durocutaneous fistulas in any patient. A subfascial drain can be used in the setting of durotomies, provided that adequate repair of the tear has been achieved and the tissue quality is satisfactory. Other authors used subfascial drains in most cases.[1] A subarachnoid drain can be an alternative for the treatment of postoperative cerebrospinal fluid leak or chronic pseudomeningocele.

A good repair of dural tear can be accompanied by postoperative bed rest. Patients from our group remained in bed rest for 3-4 days. Eismont et al,[4] found that bed rest without surgical repair was an unsuccessful method of treatment for unrepaired dural tears. Hodges et al,[7] in a retrospective review of patients, suggested that bed rest was not necessary for patients who had repair of an incidental durotomy during surgery with dural repair techniques. They reported that 75 of the patients did not need bedrest. However each of the incidental durotomies was between 1 and 3 mm in length. Wang et al,[13] systematically used bedrest for a short period (2.9 days). Cammisa et al,[2] used bed rest ranging from 3 to 5 days in all patients.

Deyo et al,[3] evaluated postoperative complications in spinal procedures. The morbidity was lower for discetomy and younger patients. Other studies have shown similar results[3,6,8,10,19] The development of pseudomeningocele is a rare complication of lumbar disc surgery.[1] Stambough et al,[11] reported one case of pseudomeningocele which was successfully managed without surgical repair, and they used a subarachnoid drain. This case was similar to a case that we had, but contrarily we re-operated the case for secondary repair. Eismont et al,[4] suggested that dural repair or reconstruction is the standard treatment for pseudomeningocele.

The rate of discitis and wound dehiscency in this study was 4.17% (1 case) for each. Weinstein et al,[14] reported an overall infection rate of 2.1% and 8.1% deep normal infection rate in durotomy cases(Table 2). The rate of orthostatic headache in our study was 6.67%. Initial management, once CSF leak is confirmed consists of bed rest and adequate hydration.[4,6,12] Stambough et al,[11] reported 3 cases of orthostatic headache (7.12%); which were successfully managed with bed rest and adequate hydration as in our study.

The presence of dural tears necessitates a prolonged hospital stay. The development of CSF fistula or deep wound infection are serious dreaded complications of dural tear in lumbar surgery, which increase much more the period of hospitalization and medical costs.

Conclusion

Incidental durotomies are a common complication of Lumbar Spine Surgery. In order to prevent or to minimize the incidental dural tears, spinal surgeries performed by experienced spine surgeons are advised. All incidental durotomies must be repaired primarily. Suture is the best way to treat dural tears. If this is not possible, muscle or fat grafts are used. A non-aspirating drainage is proposed when dural tear is adequately repaired. To reduce the hydrostatic pressure of the CSF, bed rest and antibiotics therapy are recommended.

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Address reprint request to:

Mohamed Nosseir, MD
Department of Neurosurgery, Ain Shams University, Cairo, Egypt.
Email: dr_nosseir@yahoo.com

الملخص العربي

القطع الغير متعمد للأم الجافية. نسبة حدوثه والعوامل المساعدة لحدوثه وعلاجه

البيانات الخلفية: يعتبر القطع غير المتعمد للأم الجافية من المضاعفات الشائعة لجراحات العمود الفقري للفقرات القطنية. إن نسبة حدوثه تتغير نتيجة عدة عوامل مساعدة. إن هذه الدراسة تهدف إلى قياس نسبة القطع غير المتعمد للأم الجافية أثناء جراحات العمود الفقري للفقرات القطنية والعوامل المساعدة على حدوث ذلك وكيفية علاجها أثناء وبعد الجراحة.

المرضي و الطرق: على مدار ثلاثة سنوات من يناير ٢٠١١ إلى دسمبر ٢٠١٣ تم عمل جراحات للفقرات القطنية ل ٦٣٠ مريض في قسم جراحة المخ والاعصاب طب عين شمس وتم متابعة هؤلاء المرضى لمدة حوالي ٢٤ شهر. وكانت الجراحة إما التوسيع المحدود أحادي الجانب أو التوسيع المحدود ثنائي الجانب أو إستئصال نصفي للصفائح العظمية أو إستئصال كلي للصفائح العظمية. أما الجراحات المرتجعة تم عمل جراحة لإزالة الالتصاقات أو الغضروف المرتجع. وتم عمل تلك الجراحات بواسطة جراحين مختلفين وذوي خبرة مختلفة. أثناء فترة الدراسة تم عمل جراحة إلى ٤٣٢ مريض (٦٨.٦ ٪) إنزلاق غضروفي قطني، وتم عمل جراحة إلى ١٧٢ مريض (٢٧.٣٪) ضيق بالقناة العصبية القطنية وتم عمل جراحة إلى ٢٦ مريض (٤.١٪) إنزلاق غضروفي مرتجع. وحدث قطع غير متعمد للأم الجافية في ٣٠ مريض بنسبة ٤.٧٦٪. تم قطع الأم الجافية في ١٠ حالات (٣٣.٣٣٪) من حالات الإنزلاق الغضروفي القطني و ٩ حالات (٣٠ ٪) من حالات ضيق القناة العصبية القطنية و ١١ حالة (٣٦.٦٧٪) من حالات الإنزلاق الغضروفي المرتجع. ومن أهم العوامل المساعدة السمنة والحالات المرتجعة وخبرة الجراح.

النتائج: وتم رتق الأم الجافية أثناء الجراحة مع وضع رقعة عضلية أو دهنية. كما يوجد حالتين لتسرب السائل النخاعي من الجرح تم اصلاحهما فيما بعد بجراحة أخرى وكذلك حالة واحدة لكيس سحائي تم إصلاحها بجراحة أخرى. يجب تحديد مكان قطع الأمة الجافية أثناء الجراحة حتى يتم رتقها وتجنب المضاعفات الوارد حدوثها كتسرب السائل النخاعي أو التهاب الغضروف والفقرات أو زيادة تكلفة العلاج.

الإستنتاج: لتجنب حدوث وإكتشاف وعلاج القطع الغير متعمد للأم الجافية يجب إتباع طرق جراحية سليمة وفعالة وخطة علاج ثابتة.