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Management of Incidental Lumbar Durotomy with Lumbar Drain and Fat Grafts

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Abstract

Background: Although dural tears (DTs) are known potential intraoperative complications of spine surgery, there is a relative lack of information about the true incidence of this common occurrence. Various studies have reported incidences ranging from 1.6%-17.4%. The literature on iatrogenic DT during spine surgery is surprisingly sparse; and the management is controversial.

Purpose: To evaluate the use of lumbar drain and fat graft following incidental durotomy in prevention of early CSF leak and pseudomeningocele formation later on.

Study Design: Prospective clinical case study.

Patients and Methods: 343 patients were included in this study with degenerative spinal diseases indicated for decompression (lumbar disc, canal stenosis, degenerative spondylolisthesis or revision surgery). We excluded trauma cases and ventral tears not repaired. Patients with incidental dural tear had direct primary closure and then patients were divided into two groups: group A; a lumbar drains were inserted, and group B; a fat graft was used without drain. Both groups were followed-up for CSF leak control and pseudomeningocele formation.

Results: We had 38 patients with DTs from 343 patients undergoing lumbar surgery with incidence of (11%). High incidence of DT occurred in revision surgeries (21.8%). In group (A), 85% of cases were free, 15% showed transient CSF leak managed conservatively, while in group (B), 72.2% were free, 27.7% showed transient CSF leak and 16.6% required repair for pseudomeningocele later on.

Conclusion: Incidental durotomy is a well-known complication of spine surgery, and it occurs even among experienced spine surgeons. The use of lumbar drain was more efficient than fat graft in minimizing the postoperative CSF leak and pseudomeningocele formation. (2015ESJ078)

Keywords: Incidental durotomy, Dural tear, Cerebrospinal fluid leak

Introduction

Incidental injury of lumbar dura during surgery for lumbar herniated disc or lumbar spinal stenosis represents a serious problem that needs to be recognized and immediately repaired to prevent further complications, among which CSF fistula is the most common.[2-5] The occurrence of CSF fistula increases the hospitalization period in addition to the costs of a new surgical intervention.

The incidence of unintentional durotomy during spinal operations was estimated in different series between 1.6%-17.4%,[1,11,13-15] depending on the complexity of the operation, the surgeon's experience, the type of operation (primary or reoperation), and patients age.

Several consequences of inadequately treated dural tears (DT) have been reported.[16,17] If the dural tear is not properly closed or passed unrecognized, patients can present with postural headaches, vertigo, posterior neck pain, neck and/or stiffness, nausea, diplopia, photophobia, tinnitus, and blurred vision.[18,19,23] These symptoms are caused by a persistent cerebrospinal fluid leak from the subarachnoid space. The decrease in cerebrospinal fluid pressure leads to a loss of buoyancy and caudal displacement of the intracranial content.[24]

Unrecognized or unrepaired DT can result in continued cerebrospinal fluid (CSF) leak during the postoperative period. Given this paucity of information in the literature, the incidence of DT needs to be studied in specific patient populations, such as those undergoing lumbar decompression and/or fusion for degenerative disease. Moreover, appropriate postoperative strategies for managing this complication need to be outlined.[6,8]

The literature on iatrogenic DT during spine surgery is surprisingly sparse. An accurate understanding of the true incidence and treatment of DT during lumbar spine surgery is hampered by the fact that reports in the literature have small number of patients.[2-4]

The risk of the complications of dural tears has led to the routine use of several intraoperative and postoperative measures once a dural tear is recognized. These include primary repair (with or without dural substitute and/or fibrin glue), lumbar drain placement, and postoperative bed rest.[1,2,6] Even when such precautions are taken, however, the effect of unintentional durotomy on long-term outcomes remains controversial.[17,18]

This study aims to evaluate the use of lumbar drain versus fat graft following incidental durotomy in prevention of early CSF leak and pseudomeningocele formation later on.

Patients and Methods

This is a prospective single institution study in the period from January 2012 till January 2014. It included 343 patients who have lumbar spine surgery for degenerative disease. Inclusion in the study included those who had surgery for lumbar disc, canal stenosis (laminectomy decompression), fusion for spondylolisthesis and reoperation for revisions. Moreover, dural tears dorsally or dorsolateral with successful primary repair are only included. Trauma cases, ventral and ventrolateral dural tears that are not repaired as well as arachnoid breach were excluded from this study.

Data was collected for age, sex, history of previous surgery, indication for surgery and complications. Patients were divided into two groups. Group A: dural tears were sutured primarily with a 5/0 polypropylene suture and then a lumbar drain using an epidural set is inserted at a higher level above the DTs. The drain is kept for five days postoperative then removed. Wound is daily inspected for any signs of CSF leak or presence of a pseudomeningocele. Antibiotics were given for one week postoperative; skin sutures were removed after two weeks postoperative. The other Group B: DTs are sutured but a fat graft harvested from the patient subcutaneous fat is put on lay on the tear and is kept in place with a 5/0 polypropylene suture; then the wound is closed in a watertight fashion including double layer of muscle and deep fascia with no drainage of any sort. That was followed by wound inspection postoperatively for any signs of CSF leak or later on pseudomeningocele formation.

DT Mobilization Protocol: once a patient has been identified as having a DT, the following postoperative management protocol was used: Patients were kept supine in bed rest for 24 hours. After the first 24 hours, the patients are allowed to elevate the head of bed at 30^{o} for 8 hours. If no headache occurs, they are allowed a period of trial ambulation with assistance. If they are able to tolerate the trial ambulation, they

are allowed to ambulate as tolerated. On the other hand, if the patients had recurrent headache as a result of the bed head-elevation trial, or if they have a headache with trial ambulation with assistance, the trial protocol was restarted with bed rest for 24 hours.

Both groups were followed up for three months postoperatively for any sign of CSF leak or pseudomeningocele formation. Additionally both groups were then compared for incidence of CSF leak and pseudomeningocele formation.

Symptomatic pseudomeningocele was detected clinically by the presence of fluctuant subcutaneous cystic collection at the operative site or by MRI (Figure 1, 2) when there is recurrent pain or neurological symptoms in the follow-up period.

Results

In this study 343 patients underwent surgeries for degenerative lumbar spine disease. Surgery was de novo in 311 patients and re-do in 32 patients. Age ranged from 28 to 79 years with mean age 52 years. 218 were males (63.5%) and 125 were females (36.4%). Lumbar disc prolapse was the most frequent indication for surgery (207 cases) while canal stenosis accounted for 59 cases followed by fixation (45 cases) and reoperation for 32 cases. 38 cases were identified intraoperative having incidental dural tears with incidence (11%) of all cases.

Dural tear occurred with reoperation for different cases with an incidence of 21.8% (7 cases) while for initial surgery for disc, decompression and fixation with an incidence of 10.6%, 10.1% and 6.6% respectively as shown in (Table 1).

Twenty patients (Group A) were managed by dural closure and insertion of an intrathecal lumbar drain, 17 cases (85%) were free from postoperative complications, 3 cases (15%) showed persisted CSF leak and were managed conservatively with bed rest, dressing, antibiotics and secondary suture of leaking site till the leak stopped. In the follow-up period, 2 cases (10%) had pseudomeningocele; one case (5%) was symptomatic and required reoperation with fibrin glue.

Eighteen patients (Group B) were managed by fat graft after dural closure 13 cases (72.2%) were free from early complications, 5 cases (27.8%) showed CSF leak for the surgical wound, conservative management succeeded in 3 cases (16.6%) stop the leak while 2 cases (11.1%) showed wound dehiscence and deep wound infection that required reoperation for debridement and repair. Three cases (16.6%) presented with pseudomeningocele in the follow-up period and required surgical repair. Table 2, shows a summary for the outcome and management of complications in both groups (A and B) with dural tears.

Figure 1. T2 WI MRI showing postoperative pseudomeningocele.

Figure 2. T2 WI MRI showing post L4/5 discectomy pseudomeningocele.

Table 1. Showing Dural Tears (DT) in Different Types of Surgery.

Surgery	No.	DT	%
Lumbar disc	207	22	10.6%
Laminectomy decompression	59	6	10.1%
Fixation	45	3	6.6%
Reoperation	32	7	21.8%
Total	343	38	11%

Table 3. Incidence of Dural Tear in Different Studies.

Lumbar discectomy	1%: Wang et al.[26] 7.1%: Stolke et al.[21] 3.5%: Tafazal and Sell[22]
Decompression for stenosis	3.1%: Cammisa et al.[4] 13%: Wang et al.[26] 8.5% Tafazal[21]
Fusion with instrumentation	2.0%: Cammisa et al.[4]
Revision surgery	8.1%: Cammisa et al.[4] 17.4%: Stolke et al.[21] 15.9% Khan et al.[12] 13.2% Tafazal and Sells[22]

Table 2. Summary of Outcome and Management.

Outcome			Group A	Group B
Free			17 (85%)	13 (72.2%)
CSF leak			3 (15%)	5 (22.7%)
Pseudomeningocele			2 (10%)	3 (16.6%)
Total			20 (100%)	18 (100%)
Management of complications	Leak	Conservative	3 (15%)	3 (16.6%)
		Repair and debridement	-	2 (11%)
	Pseudomeningocele	Conservative	1 (5%)	-
		Repair	1 (5%)	3 (16.6%)

Discussion

There is a wide variation in rates of incidental durotomy in the literature. The prevalence of incidental durotomy is 1.6-17.4%.[1-3] The incidence of dural tears is variable according to the indications, the type of procedures and to the different studies. Dural tears are commonly associated with complex spinal surgery and revision procedures. The morbidity is lower for younger patients and for surgeries of herniated discs. The rate was increased with age and with procedures for spinal stenosis; moreover, the incidence increases with complexity of surgery.[5,6]

In our study, we had an incidence of dural tear of 11% most frequently with revision surgeries (21.8%) followed by disc (10.6%), stenosis (10.1%) and fixation operations respectively. The incidence of incidental durotomies in different studies is shown in (Table 3).

Dural tears in these situations can be explained by the fact of the common association between the revision procedures and adhesions in the epidural space, dural scarring and loss of surgical landmarks. Excessive traction on severely herniated discs and anatomically incorrect screw placement have also been described as causative factors for dural laceration.

In our study, the mean age was 52 years for all cases and 46 years for those with dural tear. William et al,[28] did not find any correlation between the incidence of DT in relation to age while Adam et al,[1] found that durotomies occurs more frequently in the sixth decade of life.

Prevention is the most effective way to minimize the prevalence of cerebrospinal fluid leak. Preoperative planning and meticulous surgical technique are necessary to reduce the incidence of durotomies. Non operative treatment of durotomies has been unsuccessful and must be treated preioperatively.[8,10]

In our study, all 38 cases with DT were detected intra-operatively by the presence of CSF in the surgical field. Gerardi et al,[7] reported a 6.8% incidence of unrecognized dural tears. Additionally, Cammisa et al,[4] in their study, reported the incidence of unrecognized durotomies during surgery with postoperative clinical significance at 0.28% and found that its difficult to obtain the true incidence of unrecognized durotomies, because the majority of patients are asymptomatic.

Dural tears without primary repair can lead to a persistent cerebrospinal fluid leak, meningitis, arachnoiditis, pseudomeningocele, chronic pain and nerve root entrapment with resultant neurological damage. There is no baseline data on the prevalence of complications due to dural tears.

Guerin et al,[8] stated that ideally primary repair of dural tears should be done and is successful in most cases. In our study, all DT were sutured primarily followed by insertion of either intrathecal drain or fat graft followed by watertight fascial closure and bed rest and this protocol of management agreed with different studies. Many studies compared different treatment approaches to dural tears in prospective and randomized studies.

In European study Tafazal and Sell[22] reported that 58% of surgeons (24 surgeons) used Prolene® (Ethicon, Inc., Somerville, NJ), 30% used a different stitch, and 12% did not repair the dural tear. Careful and complete closure of durotomies recognized at the time of surgery was recommended for all cases. It is possible to use muscles fat graft, fibrin patch, fibrin glue, blood-soaked Surgicel® and gelatin matrix if necessary. Eismont et al,[6] recommended fascial graft secured by interrupted sutures in the treatment of larger dural defects and suggested that small dural tears can be repaired with either running locked sutures or simple sutures using a fat graft. Wang et al,[26] used 4-0 or 5-0 silk interlocking suture, Gelfoam, subfascial drain, and a layered closure, Khan et al,[12] used 4-0 nylon.

The use of drain remains controversial, in our study we inserted a lumbar drain for 20 cases for five days aiming to lower the CSF pressure and giving time for wound healing with a good outcome 85% of this group without leak in comparison with the fat graft alone (72.2%) without leak. This lumbar drain with a long subfascial tract in a valvular mechanism did not result in a durocutaneous fistula after removal.

Several studies about the use of subfascial and intrathecal drains were performed. Waisman et al,[25] found that lumbar drainage of 120 to 360 mL/day for 3 to 5 days has been associated with a complete resolution in 90% to 92% of cases. Additionally; studies have shown complete resolution of a CSF fistula with bed rest, a watertight skin closure.

Eismont et al,[6] advised against placement of

subfascial drains because it could precipitate the formation of a durocutaneous fistula. Cammisa et al,[4] 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,[26] 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. Khan et al,[12] used subfascial drains in most cases. A subarachnoid drain can be an alternative for the treatment of postoperative cerebrospinal fluid leak or chronic pseudomeningocele.

Bed rest in our study was advised only in the 1st 24 hours unless headache occurs allowing early ambulation; on the other hand, Hodges et al,[9] in a retrospective review of 20 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 bed rest. Wang et al,[26] systematically used bed rest for a short period (2.9 days). Cammisa et al,[4] used bed rest ranging from 3 to 5 days in all patients.

In our study, complications of durotomy were higher with the use of fat grafts than the lumbar drain pseudomeningocele requiring a repair were 16.6% and 5% respectively. While wound debridement and repair of DT were (11.1%) and (0%) respectively and this statistical difference favors the use of drain over fat grafts alone.

Several studies commented on the complications of durotomies. Stambough et al,[20] reported the case of a chronic pseudomeningocele which was successfully managed without surgical repair. They use a subarachnoid drain. Eismont et al,[6] suggested dural repair or reconstruction as a standard treatment for pseudomeningocele. Weinstein et al,[26] reported and overall infection rate (2.1%) in a review of 1594 patients. A higher rate of deep wound infection was observed (8.1% of 74 patients) in durotomies. However, they could not conclude that there was an increased risk of wound infection with incidental durotomies because the incidence of dural tears was highest in patients with complex revision surgery.

We have some limitations in this study including the lack of a control group, availability of sealants intra-operatively and long follow-up period for all cases.

Conclusion

Incidental durotomy is a well-known complication of spine surgery, and it occurs even among experienced spine surgeons. Revision surgery was associated with a significantly greater incidence of incidental durotomy compared with primary surgery. The gold standard treatment for incidental durotomies is primary repair with a watertight closure. The use of lumbar drain is much more efficient than fat graft in minimizing the postoperative CSF leak and pseudomeningocele formation.

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الملخص العربي

معالجة القطع العرضي للأم الجافية القطنية باستخدام درنقة قطنية ورقعة دهنية

البيانات الخلفية: برغم أن قطع الطبقة الجافية القطنية يعتبر من المضاعفات المحتملة المعروفة أثناء جراحات العمود الفقري، إلا أن هناك نقص في المعلومات عن النسب الحقيقية لحدوث هذه الظاهرة المعتادة. دراسات متعددة أوردت نسبة الحدوث ما بين ١,٦٪ إلى ١٧,٤٪. القراءات العلمية حول القطع العرضي للجافية ضئيلة وطرق علاجها مختلف عليها.

الهدف: تقييم استخدام الدرنقة القطنية والرقعة الدهنية بعد القطع العرضي للأم الجافية في منع تسريب السائل الشوكي أو أحداث قيلة سحائية كاذبة.

الطرق المستخدمة: تم إدراج ٣٤٣ مريض في هذه الدراسة يعانون من أمراض العمود الفقري التآكلية (غضروف قطني – ضيق بالقناة – تزحزح بالفقرات أو مراجعة جراحية) وتم استبعاد حالات الإصابات أو القطع الأمامي للجافية. تم تقسيم المرضى بالقطع العرضي للجافية بعد الغلق الأولي للجافية إلى مجموعتين (أ، ب)، المجموعة أ تم تركيب درنقة قطنية لهم أم المجموعة ب تم وضع رقعة دهنية لهم، ونمت متابعتهم لكشف وجود تسريب بالسائل الشوكي أو حدوث قيلة سحائية وذلك بطرق الكشف الإكلينيكية أو عمل رنين مغناطيسي.

النتائج: كان هناك ٣٨ مريض يعانون من قطع عرضي للجافية القطنية من أصل ٣٤٣ وذلك بنسبة ١١٪، والنسبة الأعلى منهم ٢١,٨٪ في حالات المراجعة الجراحية. في المجموعة (أ) لم توجد مضاعفات في ٨٥٪ من المرضى أم في ١٥٪ كان هناك تسريب مؤقت للسائل الشوكي وتم علاجه تحفظيا. في المجموعة (ب) ٧٢,٢٪ من المرضى لم يكن هناك مضاعفات أما في ٢٧,٨٪ كان هناك تسريب مؤقت للسائل الشوكي و١٦,٦٪ منهم احتاجوا إصلاح للقيلة السحائية الكاذبة فيما بعد.

الاستنتاج: أن القطع العرضي للجافية القطنية هي من المضاعفات المعروفة أثناء جراحات العمود الفقري وهي تحدث حتى مع الجراحين الأكثر خبرة، أن استخدام درنقة قطنية يعتبر أكثر كفاءة من استخدام رقعة دهنية وذلك لتقليل حدوث تسريب للسائل الشوكي أو عمل قيلة سحائية كاذبة بعد الجراحة.