

## Predictive Factors for Dural Tear in Lumbar Spine Surgery

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### Abstract

**Background Data:** Incidental durotomy is an undesirable but significant complication of lumbar spine surgery. Knowing about the predisposing factors for Incidental durotomy and meticulous surgical technique is important to avoid incidental dural tears.

**Purpose:** The purpose of this study is to clarify the risk factors for ID in lumbar spine surgery and to assess the incidence, treatment and outcome of ID.

**Study Design:** Retrospective descriptive clinical case study.

**Patients and Methods:** A retrospective review was conducted on 450 patients who underwent surgical procedure for the treatment of degenerative lumbar spinal disease. Cases included in this study were operated for disc herniation, spinal stenosis, spondylolisthesis and post-laminectomy syndrome. We excluded Patients treated for spinal tumors, trauma, infections and deformity.

**Results:** Incidental durotomies (IDs) were identified in 27 (6%) patients. The incidence of ID was much higher in revision procedures (11.9%) than in primary spinal procedures (4.6%). 18 (67%) of the 27 tears were caused by residents with the remaining 9 (33%) caused by the attending surgeon. Of the 27 dural tears 11 (40.7%) were caused by the Kerrison rongeur. All dural tears were repaired primarily. All patients achieved satisfactory outcomes other than 2 patients developed pseudomeningocele.

**Conclusion:** Risk factors that can increase the likelihood of ID were older age, obesity, previous spinal surgery and decreased experience of the surgeon. The most common instrument leading to ID is the Kerrison. Incidental durotomy can be treated successfully with primary watertight repair, subfascial drains and bed rest. (2015ESJ084)

**Keywords:** Incidental durotomy, Lumbar spine surgery, Revision surgery

## Introduction

Incidental durotomy (ID) is an undesirable but significant complication of lumbar spine surgery, with a reported incidence that varies from 1.1% to 17%.<sup>1,2</sup> Knowing about the predisposing factors for ID and its complication is a matter of utmost importance when planning and performing spinal surgical procedures. Some of the risk factors suggested to play a role in the occurrence of ID include older patient age, complex or revision surgery, a history of irradiation treatment, an overall decreased experience level of the surgeon<sup>3</sup> and the presence of pre-existing conditions such as diabetes, osteoporosis, arthritis and ossification of the ligamentum flavum.<sup>2</sup>

Complications of an ID include symptoms of low-pressure headaches, the development of subdural hematomas, acquired Chiari malformation, egress of spinal fluid from the surgical site, development of a pseudomeningocele, meningitis, arachnoiditis and neurological dysfunction related to an associated nerve root entrapment.<sup>1,2</sup> Prevention is the best way to treat the complications and disability that relates to inadvertent dural tears. Therefore spine surgeons should exercise caution to avoid ID. The purpose of this study is to clarify the risk factors for ID in lumbar spine surgery and to assess the incidence, treatment and outcome of ID.

## Patients and Methods

The records and operative notes of patients who underwent a surgical procedure for the treatment of degenerative lumbar spinal disease at our institution between May 2012 and May 2015 were retrospectively reviewed. Cases included in this study were operated for disc herniation, spinal stenosis, spondylolisthesis and post-laminectomy syndrome. Patients treated for spinal tumors, trauma, infections and deformity were excluded from this study. We collected information on demographics, diagnoses, prior spine surgeries,

details of the surgical procedure and postoperative management.

## Results

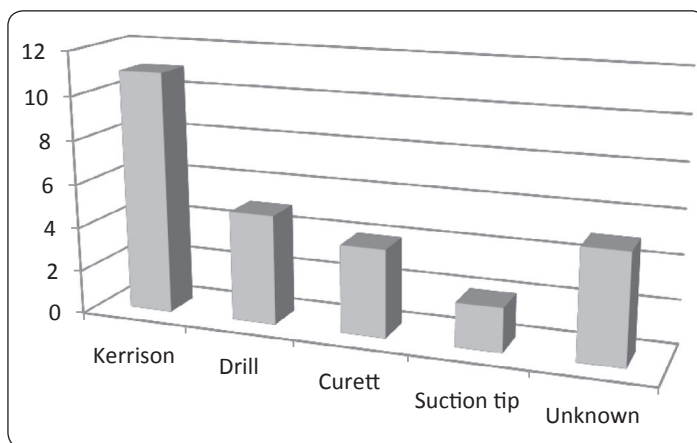
Four hundred and fifty patients with degenerative conditions of the lumbar spine were treated surgically (234 women and 216 men; mean age 48 years; age range 20–68 years). 159 patients were obese (BMI $\geq$ 30) and 291 patients were non-obese (BMI $<$ 30). IDs were identified in 27 patients with overall incidence 6%. Incidence of ID was higher in elderly patients (9.4% in patients older than 50 years and 3.3% in patients younger than 30 years). Fourteen (8.8%) of obese patients had dural tear while 13 (4.4%) of non-obese patients had dural tear.

The incidence of ID was higher in revision procedures (11.9%) than in primary spinal procedures (4.6%) (Table 1). 18 (67%) of the 27 tears were caused by residents, with the remaining 9 (33%) caused by the attending surgeon. Of the 27 dural tears 11 (41.7%) were caused by the Kerrison rongeur, 5 (18.5%) were caused by the drill, 4 (14.8%) were caused by the curette and 2 (7.4%) were caused by the suction tip. The causative factors were unknown in 5 cases (Figure 1).

All dural tears that occurred during surgery were repaired primarily with running locked sutures, and the integrity of the closure was confirmed with a valsalva maneuver. Muscle graft was used to cover the tear, and muscle was closed with interrupted sutures and fascia with continuous sutures in water tight fashion. Skin was closed with interrupted mattress sutures. Subfascial drain was inserted with no suction in all patients. All patients were placed on bed rest for 2-3 days. Intravenous antibiotics were given for 3 days postoperative. Subfascial drain was kept in place for 2 days then removed and deep stitch was taken on its exit site. All patients achieved satisfactory outcomes other than 2 patients who developed pseudomeningocele, one of them treated conservatively and the other one required a revision procedure (Figure 2 and 3).

**Table 1.** Incidence of IDs in Relation to Patient's Age, BMI and Surgery Type.

| Variables    |          | Patients | IDs | Incidence |
|--------------|----------|----------|-----|-----------|
| Age (years)  | <30      | 90       | 3   | 3.3%      |
|              | 30–      | 170      | 6   | 3.5%      |
|              | >50      | 190      | 18  | 9.4%      |
| BMI          | ≥30      | 159      | 14  | 8.8%      |
|              | <30      | 291      | 13  | 4.4%      |
| Surgery type | Primary  | 366      | 17  | 4.6%      |
|              | Revision | 84       | 10  | 11.9%     |
| Total        |          | 450      | 27  | 6%        |

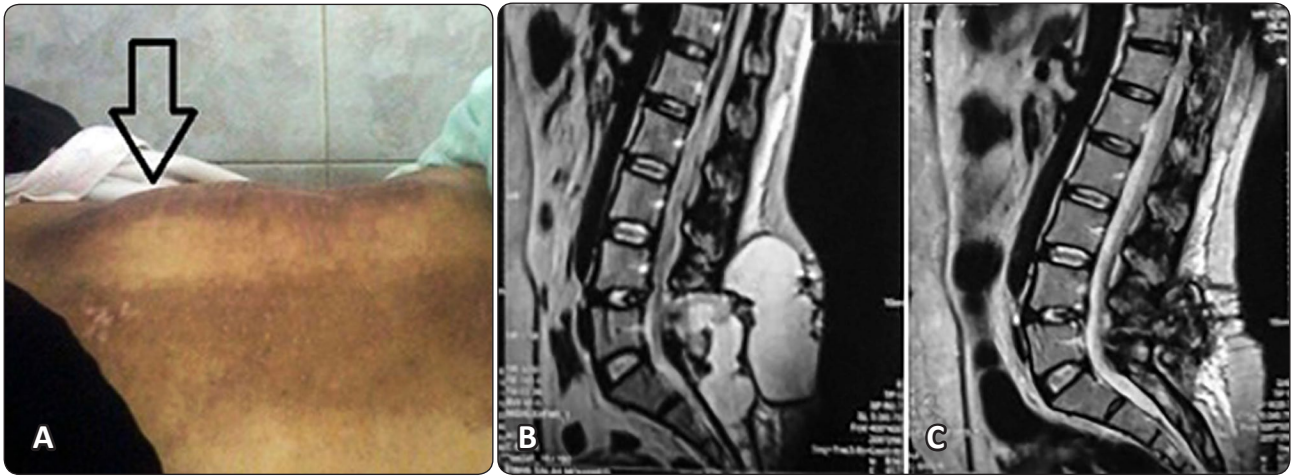


**Figure 1.** Graph showing causative instruments of ID.



**Figure 2.** (A,D) Preoperative MRI showed L4-5 disc herniation. (B,E) 6 days postoperative MRI showed pseudomeningocele, there was no leakage from the incision site. (C,F) MRI after One month showed regression of pseudomeningocele.





**Figure 3.** (A) Back swelling at the operative site due to pseudomeningocele, (B) Sagittal T2WI showing submuscular and subcutaneous CSF collection, (C) Sagittal T2WI after revision surgery to repair the defect.

## Discussion

We conducted a retrospective review on patients who underwent a surgical procedure for the treatment of degenerative lumbar spinal disease. IDs was identified in (6%) of patients. Higher incidences of ID were noted in elderly patients (9.4%), revision procedures (11.9%) and obese patients (8.8%). Kerrison rongeur was the most common instrument that causes IDs (40.7%). All dural tears were treated with primary repair in watertight fashion.

The number and complexity of spinal procedures is increasing in the last decades, leading to a greater prevalence of dural tear. Wang et al,<sup>18</sup> reported 14% incidence of ID in patients who had undergone lumbar surgery. Sin et al,<sup>15</sup> found 15.8% incidence of a dural tear in patients who underwent surgery for degenerative disorders of the spine. Jones et al,<sup>10</sup> in a review of 450 patients who underwent lumbar spine surgery, reported a 4% rate of incidental durotomies recognized at surgery. In our study the incidence of ID was 6%.

Epstein<sup>7</sup> reported that patients without dural tear were younger than those with dural tear. Our study showed higher incidence of dural tears in older patients which can be explained by reduced strength and elasticity of the dura in old age. Obesity is associated with an increased rate of ID in lumbar surgery.<sup>4</sup> Our study showed high incidence of ID in obese patients compared with non-obese patients. It was evident that patients with previous surgery more often sustained ID than patients undergoing first time surgery.<sup>16</sup> The reported incidence varies

from 15.9% in revision surgery to 3.5% in primary lumbar discectomy.<sup>1,14</sup> We found that revision procedures have a significant increased incidence of durotomy (11.9%) as compared with primary procedure (4.6%), this is due to the loss of anatomical landmarks and the postoperative adhesions which are common in revision cases. Strömqvist et al,<sup>16</sup> recommend to identify the dura in an unoperated area in the proximity of the previous operation and then carry on the dissection gently into the scarred and fibrotic area.

One factor commonly considered in ID is physician experience. Studies have documented an inverse relation between the years of Physician experience and the rate of durotomy.<sup>15,19</sup> Sin et al,<sup>15</sup> reported that 75% of dural tears were caused by a resident in training. Our study demonstrated that 67% of dural tears were caused by a resident in training. McMahon et al,<sup>12</sup> reported that The most common instrument leading to ID is the Kerrison rongeur. We found that 41.7% of ID was caused by the Kerrison rongeur, followed by the drill then the curette and suction tip. We recommend for the surgeon to be cautious while using the Kerrison and ensure good dissection before each Kerrison bit also we recommend covering the exposed dura with cottonoid while drilling and always suction on cottonoid to avoid dural tear.

Suturing is the best way to treat dural tear. We believe that good closure of muscles to reduce the dead space and watertight closure of dura and fascia are very important to prevent formation of

pseudomeningocele and CSF fistula. Studies have demonstrated that fibroblastic bridging of the dural defect beginning on postoperative day 6, with full healing occurring on postoperative day 10.<sup>5,17</sup> Therefore, decreasing the pressure at the duratomy site by bed rest may facilitate spontaneous dural healing. The use of drains is controversial, some authors<sup>6,8</sup> advise against placement of a subfascial drain due to concerns about a CSF fistula and infection. others<sup>9,18</sup> have supported the safe use of subfascial drains.

Khan et al,<sup>11</sup> found that subfascial drains were helpful in decompressing the subfascial space to prevent the build-up of CSF, which is caustic to tissue and may lead to impairment of wound healing and the formation of a fistula. Ösün et al,<sup>13</sup> Successfully used prolonged subfascial drainage in management of cerebrospinal fluid leaks after spinal surgery in 27 patients with no complications. Wang et al,<sup>18</sup> placed a drain in all cases. They found that subfascial drains did not lead to the formation of duro-cutaneous fistulas in any patient. We used Subfascial Drain in all patients with incidental durotomy with no reported complications.

## Conclusion

Risk factors that can increase the likelihood of ID according to our study might be old age, obesity, previous spinal surgery and decreased experience of the surgeon. The most common instrument leading to ID is the Kerrison. Incidental durotomy can be treated successfully with primary watertight repair, subfascial drains and bed rest.

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## الملخص العربي

### العوامل التي تؤدي إلى حدوث قطع بالأم الجافية أثناء جراحات العمود الفقري القطنية

**المقدمة:** حدوث قطع بالأم الجافية هو من الأشياء الغير مرغوب فيها ولكنه يعد من المضاعفات الواضحة أثناء جراحات العمود الفقري القطنية. ويمكن تفادي حدوثه عن طريق معرفة العوامل التي تؤدي اليه وتحري الدقة أثناء الجراحة.

**الهدف:** الهدف من هذه الدراسة هو القاء الضوء علي العوامل التي تؤدي الي حدوث قطع بالأم الجافية اثناء جراحات العمود الفقري و دراسة معدل حدوثه وكيفية علاجه ونتائجه.

**تصميم الدراسة:** دراسة وصفية اكلينيكية بأثر رجعي.

**طريقة البحث:** تم اجراء هذه الدراسة علي ٤٥٠ مريض خضعوا الي اجراء جراحة لعلاج امراض بالعمود الفقري القطني وتشمل الانزلاق الغضروفي، ضيق القناة القطنية، التمزح الفقاري ومتلازمة ما بعد جراحة العمود الفقري . وتم استبعاد المرضى الذين يعالجون من أورام او اصابات او التهابات او تشوهات العمود الفقري.

**النتائج:** تم التعرف علي حدوث قطع بالأم الجافية في ٢٧ (٦٪) مريض ، وكانت نسبة الحدوث اعلي بكثير في الجراحات المرتجعة (١١.٩٪) عنها في الجراحات الأولية للعمود الفقري (٤.٦٪). تسبب الأطباء المقيمين في حدوث قطع بالأم الجافية لعدد ١٨ (٦٧٪) مريض من أصل ٢٧ مريض ، وتسبب الاستشاريون في حدوث قطع بالأم الجافية للعدد المتبقي من المرضى ٩ (٣٣٪) وتسببت آلة الكرسون بحدوث ١١ (٤٠,٧٪) قطع بالأم الجافية من أصل ٢٧. وتم خياطة القطع بالأم الجافية وتم تحقيق نتائج مرضية لجميع المرضى ما عدا اثنين من المرضى عانوا من تجمع السائل النخاعي تحت الجلد.

**الخلاصة:** العوامل التي يمكن أن تزيد من احتمالية حدوث قطع بالأم الجافية أثناء جراحات العمود الفقري هي كبار السن والسمنة والجراحات المرتجعة للعمود الفقري وانخفاض خبرة الجراح. ويعد الكرسون من الالات الأكثر شيوعا التي تؤدي إلى حدوث قطع بالأم الجافية. ويمكن علاج القطع بالأم الجافية بنجاح عن طريق الخياطة المحكمة للقطع واستخدام الدرنة والراحة في الفراش.