Our Experience in the Management of Dural Tears in Lumbar Spine Surgery

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ABSTRACT

Introduction: Incidental durotomy is a recognized complication in spine surgery. Its management usually includes suturing and, occasionally, augmentation techniques; however, there is no consensus regarding the optimal treatment strategy. The aim of this study was to present our institutional experience in the management of incidental durotomy using a standardized dural repair protocol. **Materials and Methods:** A retrospective study was conducted including 1,040 patients who underwent posterior lumbosacral spine surgery for herniated or degenerative disc disease between 2000 and 2023. Procedures included discectomy, decompression with or without arthrodesis and instrumentation, in both primary and revision surgeries. Thirty-seven patients with incidental durotomy were identified and treated according to an institutional protocol, with a minimum follow-up of two years. **Results:** Thirty-seven of the 1,040 patients (mean age: 48 years) sustained a dural tear. All cases were diagnosed intraoperatively and treated with 4-0 nylon sutures, with local fascia augmentation according to defect size; 11 patients required augmentation. Three patients developed persistent cerebrospinal fluid leakage without associated symptoms, which was successfully managed with bed rest, Trendelenburg positioning, and acetazolamide. Two patients developed surgical site infection and required debridement and targeted antibiotic therapy. No recurrences were observed during follow-up. **Conclusions:** The institutional protocol for the management of incidental durotomy proved effective in preventing complications, reducing morbidity, and lowering associated healthcare costs. Its systematic application may contribute to standardizing the management of this complication in spine surgery.

Keywords: Durotomy; augmentation; fascia; tear.

Level of Evidence: IV

Nuestra experiencia con el tratamiento del desgarro dural en la cirugía de columna lumbar

RESUMEN

Introducción: La durotomía incidental es una complicación reconocida en la cirugía de columna, y su manejo incluye sutura y, en ocasiones, técnicas de aumentación; sin embargo, no existe consenso sobre el tratamiento ideal. El objetivo de este artículo es presentar la experiencia institucional en el manejo de este cuadro mediante un protocolo estandarizado de reparación dural. **Materiales y Métodos:** Se realizó un estudio retrospectivo de 1040 pacientes operados mediante un abordaje posterior de columna lumbosacra por enfermedad herniaria o degenerativa discal, entre 2000 y 2023. Los procedimientos incluyeron discectomía, descompresión con o sin artrodesis e instrumentación, tanto en cirugías primarias como de revisión. Se identificó a 37 pacientes con durotomía incidental, tratados según un protocolo institucional y con un seguimiento mínimo de 2 años. **Resultados:** Treinta y siete de los 1040 pacientes (edad promedio 48 años) tenían un desgarro dural. A todos se los diagnosticó durante la cirugía y trató con sutura de nailon 4.0 y aumentación con fascia local según el tamaño del defecto; 11 pacientes requirieron esta técnica. Tres tuvieron una filtración persistente de líquido cefalorraquídeo, sin síntomas, tratada exitosamente con reposo, posición de Trendelenburg y acetazolamida. Dos desarrollaron una infección en el sitio quirúrgico, y requirieron limpieza y antibioticoterapia específica. No se registraron recidivas durante el seguimiento. **Conclusiones:** El protocolo institucional de reparación de las durotomías incidentales demostró ser efectivo, permitió prevenir complicaciones, disminuir la morbilidad y reducir los costos asociados. Su aplicación sistemática podría contribuir a estandarizar el manejo de esta complicación en la cirugía de columna.

Palabras clave: Durotomía; aumentación; fascia; desgarro.

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INTRODUCTION

Incidental durotomy is a well-recognized complication of lumbar spine surgery. In a review of 641 patients who underwent lumbar spine surgery, Wang et al.[1] reported an incidental durotomy rate of 14%. Jones et al.[2] analyzed 450 patients who underwent lumbar spine surgery and reported a prevalence of incidental durotomy of 4%. Overall, reported prevalence rates range from 1% to 17%, depending on the series evaluated and the type of procedure performed.[3-9] Incidental durotomy is more frequent in revision procedures, in patients who have received radiotherapy, or in those who have undergone epidural corticosteroid injections within the three months preceding surgery.[10-12] Although several studies have shown that long-term outcomes in patients who undergo dural tear repair are favorable and even comparable to those of patients without dural tears, medicolegal complications may arise and procedural costs may increase.[1,2] In a review of malpractice litigation related to spine surgery, Goodkin and Laska reported that 23 of 146 cases, corresponding to 16%, were associated with dural tears. [13]

Several consequences or sequelae have been described, including pseudomeningocele formation, nerve root inflammation associated with sciatica or paresis, postural headache, and, when a persistent dural tear with cerebrospinal fluid fistula is present, meningitis, arachnoiditis, delayed wound healing, or surgical site infection.[3,4,14-16]

The objective of this article is to present the management of dural tears using a standardized treatment protocol implemented at our institution.

MATERIALS AND METHODS

A retrospective case series study was conducted following a repair protocol consisting of primary suture reinforced with lumbar fascia augmentation in patients with durotomy during lumbar spine surgery.

The study period extended from January 2000 to December 2023. A total of 1,040 patients who underwent surgery for disc disease of the lumbosacral spine were reviewed. Inclusion criteria comprised posterior approach procedures, including discectomy and decompression with or without arthrodesis and with or without instrumentation. Both primary and revision surgeries for lumbar degenerative disease were included, provided that all procedures were performed by the same surgical team. Patients who underwent thoracic spine surgery, those operated on through approaches other than posterior, and patients referred from other institutions with cerebrospinal fluid fistula were excluded.

All dural tears were identified intraoperatively and managed using the repair technique described below.

Repair Technique

All dural tears were repaired using 4.0 nylon with a continuous suture. Depending on tear length, greater than 10 mm, and the quality of the dura mater, repair was reinforced with augmentation using lumbar fascia harvested from the same patient at the surgical site, in 11 cases. Repair was performed with the patient in the Trendelenburg position and was assessed using the Valsalva maneuver after returning the patient to the neutral position. The fascia was closed with Vicryl® 0, the subcutaneous tissue with Vicryl® 2.0, and the skin with 3.0 nylon. No drains were used. Antibiotics were administered for 48 hours, and thromboembolism prophylaxis was maintained until patient ambulation.

Bed rest ranged from 5 to 7 days, depending on the repaired lesion and local wound conditions. Sitting was initiated on postoperative day 5, and standing on postoperative day 6 or 7.

Treatment Protocol

If an incidental durotomy occurs during surgery, primary repair with continuous suture is performed when defects measure less than 10 mm and the dura mater is preserved. Augmentation with local fascia is performed when defects measure more than 10 mm or when there is dural tearing.

In the immediate postoperative period, in cases of asymptomatic cerebrospinal fluid fistula without infection, bed rest, Trendelenburg positioning, and acetazolamide are indicated. Other options include epidural blood patch, wound sealing, and lumbar drainage. In patients with symptomatic fistula and infection, wound debridement and revision of the repair are indicated. In patients with symptoms without infection, the indication for surgical versus conservative treatment depends on the presence or absence of neurological symptoms (Figure).

Using this treatment protocol, all cases of incidental durotomy or cerebrospinal fluid fistula were resolved without sequelae.

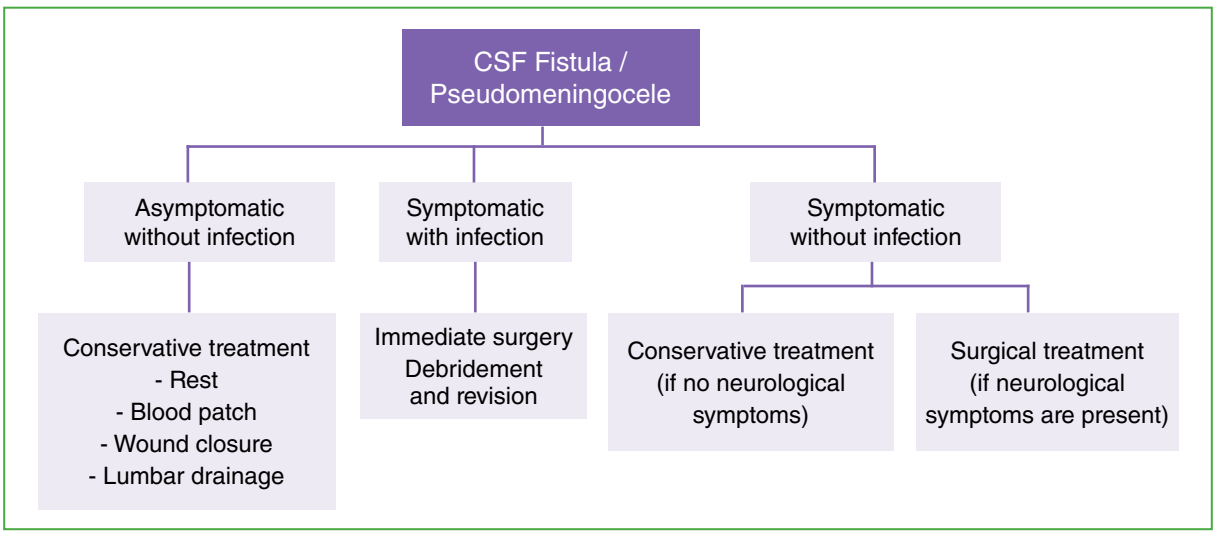

Figure. Management of cerebrospinal fluid fistula according to the protocol.
CSF = cerebrospinal fluid.

RESULTS

Thirty-seven of the 1,040 patients, corresponding to 3.5 percent, had a dural tear. The mean age was 48 years. Twenty-six cases, representing 70.2 percent, were repaired with suture alone, and 11 cases, corresponding to 29.7 percent, required augmentation with lumbar fascia. All dural tears were identified and treated intraoperatively. Thirty-two percent of the cohort, corresponding to 12 patients, had undergone previous surgery (Table).

Table. Type of surgery and incidence of dural tears.

	Number of patients	Number of patients with tears	% of dural tear
Primary surgeries	728	25	3.4
Revision surgeries	312	12	3.8
Total surgeries	1040	37	3.5

In three patients who underwent revision surgery, representing 8 percent, cerebrospinal fluid leakage from the wound persisted without symptoms or signs of infection. In these cases, bed rest in the Trendelenburg position was prolonged and acetazolamide was administered at a dose of 250 mg orally every 8 hours. Leakage resolved after three weeks of bed rest.

Two patients (5.4%) who underwent revision surgery developed surgical site infection and required wound debridement and revision of the dural defect, together with targeted antibiotic therapy.

In all patients, the condition resolved without sequelae or recurrence after more than two years of follow-up.

Fourteen patients underwent postoperative magnetic resonance imaging for reasons unrelated to the dural tear. In four of these patients, a pseudomeningocele was detected, without clinical consequences.

DISCUSSION

Therapeutic options for dural tears include primary repair with sutures, closed subarachnoid drainage, laser sealing, fat, fascia, or muscle grafting, epidural blood patching, fibrin sealants or cyanoacrylate polymer adhesives, Gelfoam®, bed rest, and avoidance of drainage. To date, the effectiveness of these different treatment strategies has not been demonstrated in prospective randomized studies. [2-4,6-8,15,17-24]

Cain et al. evaluated the repair process of dural tears created in adult Beagle dogs and reported that formation of the primary fibroblastic bridge begins from the sixth day after repair. This finding is considered when determining the duration of postoperative bed rest. Reduction of cerebrospinal fluid pressure contributes to healing of the dural defect.[14]

According to Wang et al., an unrecognized or unrepaired dural tear may not produce symptoms, but in some cases it can lead to the formation of a pseudomeningocele or a cerebrospinal fluid fistula during the postoperative period. The prevalence of this complication remains unknown.[1]

Jones et al. compared long-term outcomes in 17 patients with incidental dural tears repaired intraoperatively with those of a control group without dural tears. They found no significant differences between the two groups and concluded that intraoperative identification and repair of dural tears does not affect final outcomes or increase morbidity.[2] Wang et al. reported similar findings.[1] Our study yielded comparable results, whereas Saxler et al. reported opposing outcomes.[21]

Eismont et al. recommended careful closure of any dural tear detected during surgery, using suture plus fat grafting for small tears and suture plus fascia grafting for larger defects. They did not recommend the use of drains because of the risk of durocutaneous fistula formation.[3] In contrast, Wang et al. suggested that bed rest is ineffective for the treatment of cerebrospinal fluid fistula.[1] Hodges et al. reported similar conclusions in their study.[22]

Weinstein et al.[23] reported a surgical site infection rate of 2.1%, and Cammisa et al. reported a rate of 8.1%,[7] neither of which reached statistical significance. Long-term outcomes of procedures complicated by dural tears that were adequately repaired were comparable to those of procedures without this complication in the study by Wang et al.[1]

Lewandrowski et al. conducted a survey of spine surgeons specialized in endoscopic procedures regarding the management of incidental dural tears. They reported that 52% did not repair the dural tear, 40% used sealants, and 8% performed direct repair. The postoperative fistula rate was negligible at 0.025%. However, rates of radiculopathy associated with incidental durotomy were 12.4% for dysesthesia, 3.4% for hyperesthesia, and 2.2% for muscle weakness. The published study did not include a standardized treatment protocol.[25]

In our study group, lumbar dural tears in 37 patients were repaired using 4.0 nylon suture, with or without fascia augmentation according to defect size, in order to prevent the complications described in the literature.

The strengths of this study include extensive experience in the management of this condition, as well as the implementation of a standardized intraoperative and postoperative treatment protocol for dural tears. Patient follow-up was conducted by the same surgical team.

CONCLUSIONS

A two-year follow-up using the institutional protocol for the repair of incidental lumbar dural tears described above allowed effective management of this intraoperative complication, avoiding postoperative sequelae, reducing morbidity, and lowering associated costs. Systematic application of this protocol may contribute to standardizing the management of incidental dural tears in spine surgery.

Conflict of interest: The authors declare no conflicts of interest.

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