Management of Incidental Dural Tear During Lumbar Spine Surgery. To Suture or Not to Suture?

Maria Kamenova[1,2], Severina Leu[1,2], Luigi Mariani[1], Stefan Schaeren[2], Jehuda Soleman[1,2]

■ OBJECTIVE: **Incidental durotomy (ID) during lumbar spine surgery is a frequent complication of growing clinical relevance as the number and complexity of spinal procedures increases. Yet, there is still a lack of guidelines for the treatment of ID with a large heterogeneity of established surgical techniques. The aim of this study was to investigate the efficacy of dural suturing in patients having ID during degenerative lumbar spine surgery, compared with other dural closure techniques.**

■ METHODS: **Of 1173 consecutive patients undergoing degenerative lumbar spine surgery from July 2013 to March 2015, in 64 (5.4%) patients 69 (5.8%) IDs occurred. The patients were divided into 3 groups depending on the dural closure technique used: group A, sole dural suture ($n = 12$, 19%); group B, patch only (TachoSil and/or muscle and/or fat) ($n = 22$, 32%); group C, dural suture in combination with a patch ($n = 34$, 49%). The primary end point was revision surgery caused by complications of cerebrospinal fluid leakage after 6 weeks. The secondary end points were operation time and hospitalization time, as well as surgical morbidity.**

■ RESULTS: **The 3 groups showed no significant difference in rates of revision surgery (group A: $n = 1$, 1.4%; group B: $n = 4$, 5.8%; group C: $n = 3$; 4.3%; $P = 0.5$). Furthermore, no significant difference for hospitalization time, operation time, and clinical outcome was found. Extent of ID, American Society of Anesthesiology score, postoperative immobilization, and insertion of a drainage tube were not associated with higher rates of revision surgery. Applying suction once a drainage tube was placed was found to be a significant risk factor for revision surgery ($P = 0.003$). Furthermore, patients undergoing revision surgery had a significantly higher body mass index (33 kg/m^2 vs. 26.37 kg/m^2; $P = 0.006$; odds ratio 1.252; $P = 0.004$).**

■ CONCLUSIONS: **Based on our results, the dural closure technique after ID does not seem to influence revision surgery rates due to cerebrospinal fluid leakage and its complications. Further prospective randomized studies are needed to confirm our results.**

INTRODUCTION

Incidental durotomy (ID) is a common complication in spine surgery, with an incidence ranging from 1% to 17%,[1-10] generally depending on the complexity of the surgical procedure.[1,2,10,11] Increasing age, revision surgery, operation for spinal stenosis or synovial cysts,[1,10,12,13] marked ossification of the ligamentum flavum or the posterior longitudinal ligament, as well as the usage of a high-speed drill are well-known risk factors for the occurrence of ID.[2,9,14,15] Controversial data[9] exist about the relationship between surgical experience and the rate of ID, with some investigators[16,17] reporting an inverse correlation and others[18] reporting that the years of surgical training are not a major risk factor.

In most cases, ID occurs unpredictably, with a variable size ranging from a pinpoint hole to several centimeters.[18] If ID is unrecognized or insufficiently treated, a multitude of consequences such as postural headache, nausea, vomiting, neck or back pain, dizziness, and VI cranial nerve palsy leading to diplopia, photophobia, and tinnitus could occur.[6,19,20] In some cases, consecutive cerebrospinal leakage

Key words
- Closure techniques
- Dural suturing
- Incidental dural tear
- Lumbar spine surgery

Abbreviations and Acronyms
ASA: American Society of Anesthesiology
BMI: Body mass index
CSF: Cerebrospinal fluid
ID: Incidental durotomy
OR time: operating time

From the [1]Departments of Neurosurgery and [2]Spine Surgery, University Hospital of Basel, Basel, Switzerland

To whom correspondence should be addressed: Maria Kamenova, M.D. [E-mail: maria_kamenova@web.de]

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might cause cerebrospinal fluid (CSF) fistula formation, pseudomeningocele, meningitis, arachnoiditis, wound and surgical site infections, or epidural abscess.[1,5,11,19]

Primary repair is the treatment of choice and if it is successful, the long-term clinical outcome is excellent.[13,21,22] Dural suturing has been reported to be the gold standard for achieving permanent closure.[1,10] However, other surgical techniques have been established and used in a variable fashion, including the application of muscle fascia or fat patch, insertion of fibrin glue or other closure materials such as Spongostan (Johnson & Johnson Medical, Spreitenbach, Switzerland), TachoSil (Takeda Pharma AG, Freienbach, Switzerland), Gelfoam (Pharmacia and Upjohn Company, USA; EU Authorised Representative Pfizer Manufacturing Belgium NV).[23-25] Evidence-based studies evaluating these closure techniques and providing guidelines for the treatment of ID are lacking.

In the present study, we aim to evaluate the efficacy of dural suturing in patients having ID during degenerative lumbar spine surgery compared with other dural closure methods.

METHODS

Of 1173 consecutive patients undergoing degenerative lumbar spine surgery from July 2013 and March 2015 at the University Hospital of Basel, 69 IDs (5.8%; 34 females, 49.3%) in 64 patients (5.4%) occurred. Based on the surgical dural closure technique, the patients were divided into 3 groups: group A, dural suture only ($n = 13$, 18.8%); group B, patch only, using TachoSil and/or muscle and/or fat ($n = 22$, 31.8%); and group C, dural suture in combination with a patch ($n = 34$, 49.4%). The chosen closure technique was based on the treating surgeon's decision.

The diagnosis of all patients was either lumbar disc herniation ($n = 12$, 17.4%) or spinal canal stenosis ($n = 57$, 82.6%) with ($n = 36$, 52.2%) or without spinal instability. For lumbar disc herniation, a microscopic fenestration, recessotomy, foraminotomy, and sequestrectomy with or without discectomy were performed, whereas for spinal canal stenosis, a microscopic fenestration, flavectomy, recessotomy, and foraminotomy were performed. In patients presenting with additional spinal instability, transpedicular screw fixation and transforaminal lumbar interbody fusion with dorsal bone fusion was simultaneously performed. In selected cases, a drainage tube was placed under the muscle fascia. The decision whether to place a drainage tube and whether to place it under suction was undertaken by the surgeon intraoperatively. None of the drainage tubes was secondarily placed under suction because of factors occurring postoperatively (e.g., wound leakage).

Distribution of age, sex, underlying medical disease, surgery performed, recurrent surgery, and number of operated segments in each group are shown in Table 1. The groups were well matched overall. However, body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) (group A: 23.6; group B: 29.8; group C: 26.8; $P = 0.013$) and American Society of Anesthesiology (ASA) score (group A: 2.15; group B: 2.32; group C: 2.62; $P = 0.016$) were significantly different between the groups.

The extent of ID, insertion of a drainage tube within the muscle compartment, whether the drainage tube was placed on suction or not, days until postoperative mobilization, and the insertion of a lumbar drainage tube during the postoperative period were also noted (Table 3). In addition to revision surgery as a result of CSF leakage, the operation (OR) and hospitalization time, other postoperative complications, such as a postoperative hematoma requiring reoperation and surgical site infections managed conservatively, were also compared. The primary end point was revision surgery caused by subcutaneous collection of CSF, CSF fistula, and/or pseudomeningocele after 6 weeks. The secondary end points were hospitalization time, operative time, and surgical morbidity at 6 weeks.

All statistical analyses were performed using Instat GraphPad (GraphPad Software Inc., La Jolla, California, USA) and IBM SPSS Statistics 21 (IBM Corp., Armonk, New York, USA). Contingency tests were performed using the χ^2 or the Mann-Whitney U test, and all other calculations were performed using the 1-way analysis of variance test. For those variables showing a significant difference between the groups, univariate and multivariate logistic regression analysis was performed, to elucidate their role as potential cofounders for revision surgery. A P value of < 0.05 was considered significant.

RESULTS

Revision Surgery Rates

Overall revision surgery rate was 11.6% ($n = 8$), and 1 (7.7%), 4 (18.2%), and 3 (8.8%) patients underwent revision surgery as a result of complications of CSF leakage in groups A, B, and C, respectively, showing no significant difference ($P > 0.05$). The comparison between group B, in which no suture was undertaken, and groups A and C, in which at least a suture as repair technique was undertaken, still showed no significant difference in revision surgery rates ($P > 0.05$, Table 2).

Hospitalization Time, OR Time, and Surgical Morbidity

Hospitalization time was 8.9 days (± 3.1 days) in group A, 15.45 days (± 12.7) in group B, and 11.56 days (± 5.2 days) in group C, showing no statistical significant difference ($P > 0.05$, Table 2). OR time was 219.8 minutes (± 109.7 minutes), 169.7 minutes (± 82.3 minutes), and 191.7 minutes (± 72.2 minutes) in groups A, B, and C, respectively, with no significant difference between the groups ($P > 0.05$, Table 2). Even after correcting the OR time for the number of segments (OR time/amount segments operated), no significant difference was seen (Table 2). Surgical morbidity rate was 15.4% ($n = 2$), 4.5% ($n = 1$), and 5.9% ($n = 2$) in groups A, B, and C, respectively, showing no significant difference (Table 2).

Covariables

All IDs in our cohort were located dorsally and were therefore well visible and accessible for repair. The extent of ID showed no significant difference between the 3 groups ($P = 0.31$, Table 3). Furthermore, no significant association between ID size and revision surgery was found ($P = 0.89$). The ID size was missing in 5 (38.5%), 6 (27.3%), and 12 (36.4%) patients in groups A, B, and C, respectively. From all the covariables collected and analyzed, BMI and ASA score were the only ones showing significant difference between the groups (Table 1).