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# The Long-term Clinical Sequelae of Incidental Durotomy in Lumbar Disc Surgery

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**Study Design.** A retrospective, long-term follow-up study.

**Objectives.** To find out whether incidental durotomy in lumbar disc surgery is associated with long-term sequelae.

**Summary of Background Data.** Incidental durotomy is a frequent complication during spinal surgery. Little is known about the clinical long-term outcome.

**Methods.** The study population comprised 1,280 patients who underwent standard discectomy of a lumbar disc herniation. A total of 41 patients with incidental durotomies (Group A) were compared with a control group (n = 41) (Group B) matched for age, sex, spinal level, and duration of follow-up. After a mean follow-up period of 10.2 years (Group A) or 10.3 years (Group B), the patients reported complaints, headache, and low back or leg pain. The patients' activity was assessed by means of a questionnaire concerning hindrance in daily activities, the Tegner score for general activities in daily life, and the Hannover Functional Ability Questionnaire for Measuring Back Pain-Related Functional Limitations (FFbH–R). The frequency of reoperation and the intake of analgesics were included. Furthermore, the patients' inability to work, change of profession, and retirement were registered.

**Results.** Patients with incidental durotomy had a poorer outcome after surgery. The Tegner score was significantly decreased for the group with dural tears. Furthermore, significant more patients with incidental durotomy complained about headaches after surgery. A strong tendency for worse outcome in Group A was shown in regard to reported complaints and daily activity. The patients with incidental durotomy had a tendency to more reoperations, a longer duration of inability to work, more back-pain, and functional limitations related to back-pain (FFbH-R).

**Conclusion.** Our study revealed that incidental durotomy in lumbar disc surgery was associated with long-term clinical sequelae. We therefore conclude that dural tears bring about poor clinical outcome at the long-term follow-up.

**Key words:** incidental durotomy, spine surgery, discectomy, long-term sequelae. **Spine 2005;30:2298–2302**

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Incidental durotomies are a frequent complication during spinal surgery.[1] They have a potential of legal ramifications and concomitant financial costs. In a review of malpractice lawsuits involving spinal operations, Goodkin and Laska[2] found that unintended incidental durotomy accounted for 23 of 146 suits (16%).

Various consequences of dural tears have been reported. A persistent dural tear may lead to a meningeal pseudocyst formation, with possible nerve root entrapment and resultant neurologic damage such as sciatica and cranial nerve insufficiency or palsy, particularly of the sixth cranial nerve with strabism. Additionally, headache may occur, especially when the patient verticals the body position. In case of persisting dural tear, dural cutaneous fistulas may form, leading to meningitis, arachnoiditis, delay of wound healing, or wound infection.[1–8]

In lumbar spine surgery, the prevalence of dural tears is 1% to 17% and varies according to the series reviewed as well as the type of surgical procedure performed.[4,5,9–15] Deyo *et al*[16] evaluated postoperative complications, including dural tears, in a large series of spinal procedures. The morbidity was lower for younger patients and for surgery of herniated discs. In contrast, the rate was increased with age and with procedures for spinal stenosis or reoperations. Other authors confirmed this aspect.[4,11,13,15,17]

Different studies investigated the clinical outcomes of patients with incidental durotomies. No long-term sequelae were found when the patients were treated successfully for incidental durotomies during surgery.[4,11,13,15]

The purpose of the present study was to find out whether incidental durotomy increases the incidence of long-term sequelae in a homogeneous group of patients with herniated lumbar discs.

## Materials and Methods

From January 1981 to December 1996, a consecutive series of 1,280 patients with surgery of herniated lumbar discs was included in this study. A total of 41 cases of incidental durotomies were compared with a control group matched for age, sex, spinal level, and duration of follow-up. At surgery, the mean age of the patients with incidental durotomy (Group A) was 43.1 years (range, 23.8–66.2 years). In the control group (Group B), the patient age was 42.0 years (range, 24.2–64.4 years). In both groups, 16 female and 25 male patients were included. The mean follow-up period was 10.2 years (range, 4.2–18.5 years) for Group A and 10.3 years (range, 4.4–18.4 years) for Group B. Reoperation cases were excluded. Nerve root compression was diagnosed *via* computed tomography, myelography, or magnetic resonance imaging (MRI). The indi-

**Table 1. Postoperative Assessment of Complaints in Patients With and Without Dural Tear**

| Complaint | All Patients (n = 82) | | Male Patients (n = 50) | |
|---|---|---|---|---|
| | With Dural Tear (n = 41) (%) | Without Dural Tear (n = 41) (%) | With Dural Tear (n = 25) (%) | Without Dural Tear (n = 25) (%) |
| Permanently free of complaints | 7.3 | 14.6 | 8 | 20 |
| Initial free of complaints, then just improvement | 63.4 | 68.3 | 56 | 76 |
| Permanent improvement | 4.9 | 7.3 | 0 | 0 |
| Initial improvement, then the same complaints | 2.4 | 2.4 | 4 | 0 |
| Same complaints | 7.3 | 4.9 | 8 | 4 |
| Initial improvement, then worse | 7.3 | 0.0 | 12 | 0 |
| No effect | 7.3 | 2.4 | 12 | 0 |
| *P* (Wilcoxon test) | 0.151 | | 0.005 | |

cations for surgery were untreatable radicular pain, motor or sensible nerve root deficits, or cauda symptoms. All patients underwent surgery because of a lumbar disc herniation that was confirmed during surgery. The spinal levels treated were: L3–L4 (2 cases), L4–L5 (22 cases), and L5–S1 (17 cases) for both groups. Standard discectomy was performed in all patients, and in needs with microscopic support, only minor osseous decompression was performed, if necessary. Subfascial or subarachnoid drains were not used. During surgery, 24 dural tears were repaired with running locked suturing of the defect with 5-0 prolene suture; 11 were repaired with a fat graft derived from the subcutaneous tissue combined with Gelfoam; in 6 cases of petty durotomies, the dura was not closed by any specific treatment. The patients with surgically repaired dural defects were not confined to bed longer than other patients.

Clinical assessment was carried out by an independent clinical examiner blinded to incidental durotomy. A questionnaire included postoperative assessment of complaints. The patients were asked about headache and low back or leg pain. The patients were asked to score the pain level on a scale from 1 to 10: 1 indicates no pain and 10 indicates severe pain with minimal activity. A specific questionnaire about hindrance in daily activity, the Tegner score,[18] and the Hannover Functional Ability Questionnaire for Measuring Back Pain-Related Functional Limitations (FFbH-R)[19] were used to assess patients' activity. The FFbH-R contains 12 questions concerning the activities of daily life. This questionnaire can be completed by the patients themselves and is therefore also suitable for postal interviews. The maximum score is 35, while the tested reference value is 20.4 for a healthy population aged 25 to 74 years. The frequency of reoperation and the intake of analgetics were included. Duration of inability to work, change of profession, and retirement were also asked (Tables 1–5).

The Wilcoxon and McNemar tests were used to analyze the differences between the groups with incidental durotomies and the control group. Significance was set at $P = 0.05$.

Because of the small sample size, we comprised the following points into two outcome levels: questionnaire of complaints, headache, back pain, hindrance in daily activities, Tegner score, FFbH-R, reoperation, and inability to work. When appropriate, we calculated odds ratios (OR) with 95% confidence intervals (CI), according to Wald's formula.

## ■ Results

The incidence of dural tears in 1,280 patients with lumbar disc surgery was 3.2%. No persistent cerebrospinal fluid leak or pseudomeningoceles occurred and revision surgery was not related to incidental durotomy.

In Group A, 75.6% were permanently free of complaints compared with 90.2% in Group B. At the time of follow-up, 24.3% of patients with durotomy reported no improvement, compared with 9.7% in the control group. In Group A, 7.3% had increased complaints, while in Group B none of the patients had increased complaints. The OR for persistent pain was 2.98 (CI, 0.86–10.39). When the patient outcomes were stratified by gender, male patients without dural tears reported significantly better results ($P = 0.005$, Wilcoxon test) (Table 1); the OR was 13.5 (CI, 1.57–115.86) for the males.

**Table 2. Hindrance in Daily Activity in Patients With and Without Dural Tear**

| | All Patients (n = 82) | | Female Patients (n = 32) | |
|---|---|---|---|---|
| | With Dural Tear (n = 41) (%) | Without Dural Tear (n = 41) (%) | With Dural Tear (n = 16) (%) | Without Dural Tear (n = 16) (%) |
| 1 (every activity) | 12.2 | 17.1 | 6.3 | 12.5 |
| 2 | 2.4 | 7.3 | 0.0 | 18.7 |
| 3 | 14.6 | 4.9 | 18.7 | 12.5 |
| 4 | 4.9 | 14.6 | 6.3 | 12.5 |
| 5 | 22.0 | 34.1 | 31.3 | 18.7 |
| 6 | 7.3 | 2.4 | 12.4 | 6.3 |
| 7 | 14.6 | 2.4 | 6.3 | 6.3 |
| 8 | 7.3 | 12.2 | 6.3 | 12.5 |
| 9 | 2.4 | 0.0 | 0.0 | 0.0 |
| 10 (minimal activity only) | 12.2 | 4.9 | 12.4 | 0.0 |
| *P* (Wilcoxon test) | 0.062 | | 0.027 | |

**Table 3. Tegner Score (20) for General Activity in Patients With and Without Dural Tears (n = 82)**

| | With Dural Tear (n = 41) (%) | Without Dural Tear (n = 41) (%) |
|---|---|---|
| Regular work impossible | 7.3 | 4.9 |
| Only sedentary work possible | 14.6 | 2.4 |
| Only light work possible | 41.5 | 39.0 |
| Normal work | 34.1 | 43.9 |
| Heavy work | 0.0 | 2.4 |
| Very heavy work | 0.0 | 0.0 |
| Leisure time sport | 2.4 | 4.9 |
| Leisure time and competitive sport | 0.0 | 2.4 |
| Intensive sport | 0.0 | 0.0 |
| Very intensive sport | 0.0 | 0.0 |
| *P* (Wilcoxon test) | 0.033 | |

At the time of follow-up, 31.7% of the patients with incidental durotomy complained about headaches after surgery compared with 9.8% in the control group ($P = 0.035$, McNemar test). OR for headache was 4.29 (CI, 1.27–14.51).

On the scale for back pain, 60.9% of patients with incidental durotomy and 51.2% of the controls scored between 6 and 10 ($P = 0.216$, Wilcoxon test), with an OR for back pain of 1.49 (CI, 0.62–3.56). Within this 6 to 10 range, there was no difference between Group A and Group B (46.4% *vs.* 46.3%) for leg pain ($P = 0.745$, Wilcoxon test).

The hindrance in daily activities showed a tendency to worse results for the group with dural tears (Table 2); but because of the small sample size, significance was not reached ($P = 0.062$). When analyzed by gender, significantly worse results were observed for female patients with dural tears ($P = 0.027$). The OR was 2.78 overall (CI, 1.07–7.25), 1.80 for the female (CI, 0.40–8.15), and 5.23 for the male subpopulation (CI, 1.56–17.56).

The Tegner score showed significantly better results in the control group (Table 3); 63.4% of the patients in Group A were not able to perform normal work or sports activities in contrast to 46.3% in Group B.

On the FFbH-R, the mean score of Group A was 20.2 and of Group B 18.2, ($P = 0.175$ Wilcoxon test), with an OR of 1.36 (0.56–3.27).

There was no significant difference between the two groups with respect to intake of analgetics at the time of follow-up ($P = 0.873$, Wilcoxon test). The frequency of reoperation at the same spinal level was in Group A 19.5% and in Group B 12.2% of the patients. A tendency to more reoperations in Group A, with an OR of 1.75 (CI, 0.52–5.84) was shown.

**Table 4. Duration of Inability to Work After Surgery in Patients With and Without Dural Tears (n = 82)**

| Inability | With Dural Tear (n = 41) (%) | Without Dural Tear (n = 41) (%) |
|---|---|---|
| None | 2.4 | 4.9 |
| For days | 4.9 | 4.9 |
| For weeks | 17.1 | 24.4 |
| For months | 68.3 | 65.8 |
| For years | 7.3 | 0 |
| *P* (Wilcoxon test) | 0.182 | |

**Table 5. Early Retirement and Change of Profession in Patients With and Without Dural Tears (n = 82)**

| | With Dural Tear (n = 41) (%) | Without Dural Tear (n = 41) (%) |
|---|---|---|
| Early retirement | | |
| Yes | 9.8 | 9.8 |
| No | 90.2 | 90.2 |
| *P* (McNemar test) | 1.000 | |
| Change of profession | | |
| Yes | 14.6 | 17.1 |
| No | 85.5 | 82.9 |
| *P* (McNemar test) | 0.508 | |

The patients with dural tears had a tendency to a longer duration of inability to work (OR, 1.61; CI, 0.62–4.18) (Table 4). The majority of the patients did not work for several months. The number of patients who went into early retirement after surgery was the same in both groups (Table 5), while the number who changed profession after surgery was similar in both groups (Table 5).

## ■ Discussion

This study presents, for the first time, the long-term outcomes over 10 years of patients treated successfully for incidental durotomies during surgery. The study was based on a questionnaire and two well-known score systems. Patients with incidental durotomy had a poorer outcome after surgery.

Recommendations for the treatment of dural tears have included primary repair with sutures, closed subarachnoid drainage, laser tissue welding, muscle, fat, or fascia-grafts, blood patches, fibrin-adhesive or cyanocrylate polymer sealant, Gelfoam, bed rest, and avoidance of wound drains.[3–5,7,10,12,13,20–24] Subarachnoid drains are effective when a persistent dural leak cannot be repaired operatively.[13] However, the routine use of these drains is not recommended, as most dural tears do not lead to persistent leaks.[15] The efficacy of the different treatments has not been compared in randomized studies in the literature until today.

Barrios *et al*[9] demonstrated that the presence of intraoperative complications, such as dural tears, error level, or root damage, are potential indicators of poor prognosis. Incidental durotomy is more likely to occur if there is scar tissue from prior surgery or irradiation[25,26] and the prevalence of dural tears is more common in association with complex spinal surgery or revision procedures.[15,24]

In four series comparable to our study, 189 incidental durotomies were investigated with a follow-up period from weeks to less than 5 years. No sequelae were found when the patients were treated successfully for incidental durotomies.[4,11,13,15] In these articles, only 3 patients were treated by standard discectomy; all the other pa-

tients were treated by more complex spinal surgery. In contrast to that, the patients of our study were a homogeneous group with a lumbar disc herniation and therefore did not require treatment for spinal stenosis of the facet joints, scar tissue from prior surgery, or irradiation. Complex surgery was not necessary. The clinical outcome of patients who have undergone decompression or revision surgery interbody spine fusion surgery cannot be compared with that of patients who required standard discectomy only. Furthermore, patients with spinal stenosis are elderly and usually polypathic.[27,28]

Jones *et al* used a detailed follow-up questionnaire and examination. The authors suggested that morbidity and clinical outcomes are not adversely effected if dural tears are identified and successfully repaired at primary surgery,[13] but in this study only 17 cases with dural leaks were identified.

The maximum length of follow-up in the literature of patients with incidental durotomy was, to our knowledge, 4.3 years.[4,11,13,15] In our study, the time of follow-up was over 10 years for both groups. The clinical outcome of patients after lumbar spine surgery tend to give an overall optimistic success rate in short-term studies.[29,30] In contrast, studies with long-term follow-up have shown unsatisfactory results up to 60%.[23,31,32] For this reason, the results of clinical outcome measures between the previous studies concerning incidental durotomy and our study are not comparable. Davis[33] suggested that, in order to evaluate adequately the results of spine surgery, the follow-up period should be more than 4 years.

The 41 patients of the present study with incidental durotomy had a strong tendency to report more complaints and demonstrated a worse outcome regarding daily activity questions but without statistical significance. Furthermore, they had a worse outcome regarding Tegner score and a higher rate of headache. They also had a tendency to more reoperations, a longer duration of inability to work, more back pain, and FFbH-R. All calculated ORs showed an important difference, but the CIs were wide and usually included 1.0 because of the small sample size. Significance was shown for some gender specific analysis (Tables 1, 2), but we think that there is essentially no difference between the genders and the significant gender specific results are random. However, the overall tendency toward long-term sequelae is obvious and clinically important. In contrast, no clinical differences were demonstrated with regard to leg pain, the intake of analgetics, change of profession, and retirement.

The closure of the dural leak in our patients was performed with running locked suturing, fat grafts combined with Gelfoam; and in 6 cases of petty durotomies, the dura was not closed by any specific treatment. With our data, we cannot recommend a preferable method for dural closure because the numbers were too small for this type of analysis to be of value.

In contrast to the few articles on the subject, we have shown that incidental durotomies may cause long-term sequelae. But the present study is neither large enough for definitive conclusions nor appropriate to discuss the source of these increased sequelae. In a recent unpublished animal study, we could demonstrate, after laminectomy with durotomy, more dural adhesions and an up-regulation of nociceptive afferents that innervate the dura mater. We speculate that these findings might cause among other things that demonstrated long-term sequelae.

## ■ Conclusion

In contrast to previous studies, incidental durotomies in lumbar disc surgery were associated with long-term clinical sequelae. We therefore conclude that dural tears bring about poor clinical outcome at the long-term follow-up. In further investigations, it has to be clarified whether the method of dural closure has any effect on the results.

### ■ Key Points

- Patients with incidental durotomy had a poorer outcome after surgery. The Tegner score was significantly decreased for the group with dural tears.
- Significantly more patients with incidental durotomy complained about headaches after surgery.
- A strong tendency for worse outcome in the patients with incidental durotomy was shown in regard to reported complaints and daily activity. The patients with incidental durotomy had a tendency to more reoperations, a longer duration of inability to work, and more back pain and functional limitations related to back pain.
- Incidental durotomy in lumbar disc surgery is associated with long-term clinical sequelae, and dural tears bring about poor clinical outcome at the long-term follow-up.

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