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THE IMPACT OF DURAL TEAR ON SEEMINGLY UNRELATED PERIOPERATIVE COMPLICATIONS IN SURGICAL TREATMENT OF LUMBAR DEGENERATIVE DISEASES

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Background

Dural tear is a relatively common complication.

| | | | |
|------------------------------|----------|--------------|-------------------------------------|
| Lumbar disc herniation | N = 4173 | 2.7% | <i>Stromqvist. Eur Spine J 2010</i> |
| Lumbar degenerative diseases | N = 4020 | 4.4% | <i>Papavero. Eur Spine J 2015</i> |
| Lumbar degenerative diseases | N = 3183 | 10.6% | <i>Khan. Spine 2006</i> |

The short-term and long-term consequences of dural tear remain controversial.

Optimistic

Desai. Spine 2012
Guerin. Injury 2012
Adogwa. The Spine J 2015

vs

Pessimistic

| | |
|-----------------|------------------------------------|
| Nonunion in PLF | <i>Bydon. J Clin Neurosci 2015</i> |
| High cost | <i>Puvanesarajah. Injury 2012</i> |
| Meningitis | <i>Lin TY. BMC Infect Dis 2014</i> |
| Low ADL | <i>Saxler. Spine 2005</i> |

Purpose

Question

Is dural tear associated with an increased rate of other perioperative complications?

We addressed this question and ensured sufficient statistical power using a registry of prospectively collected multicenter data that originally focused on perioperative complications.

Methods

Prospective multicenter analysis

N = 13188 primary degenerative lumbar spinal surgery
(deformity excluded)

7174 men (54%) avg. 64.8 years

6104 women (46%) avg. 68.7 years

From January 2012 to December 2017

26 affiliate institutions

The same questionnaires (MS Excel)

- ✓ Age, sex
- ✓ Disease information (Major & minor criteria)
- ✓ Surgery information (Major & minor criteria)

Intraoperative surgery-related complication

- ✓ Dural tear (requiring additional intraoperative procedures)
- ✓ Massive hemorrhage (> 2 L)
- ✓ Nerve injury
- ✓ Screw malposition
- ✓ Cage/graft dislocation
- ✓ Wrong site surgery
- ✓ Vascular injury

Postoperative surgery-related complication

- ✓ Dural leak
- ✓ Postoperative neurological deficit
- ✓ Surgical site infection (requiring revision)
- ✓ Hematoma (requiring revision)
- ✓ Wound dehiscence
- ✓ Screw/Rod failure
- ✓ Cage/graft failure

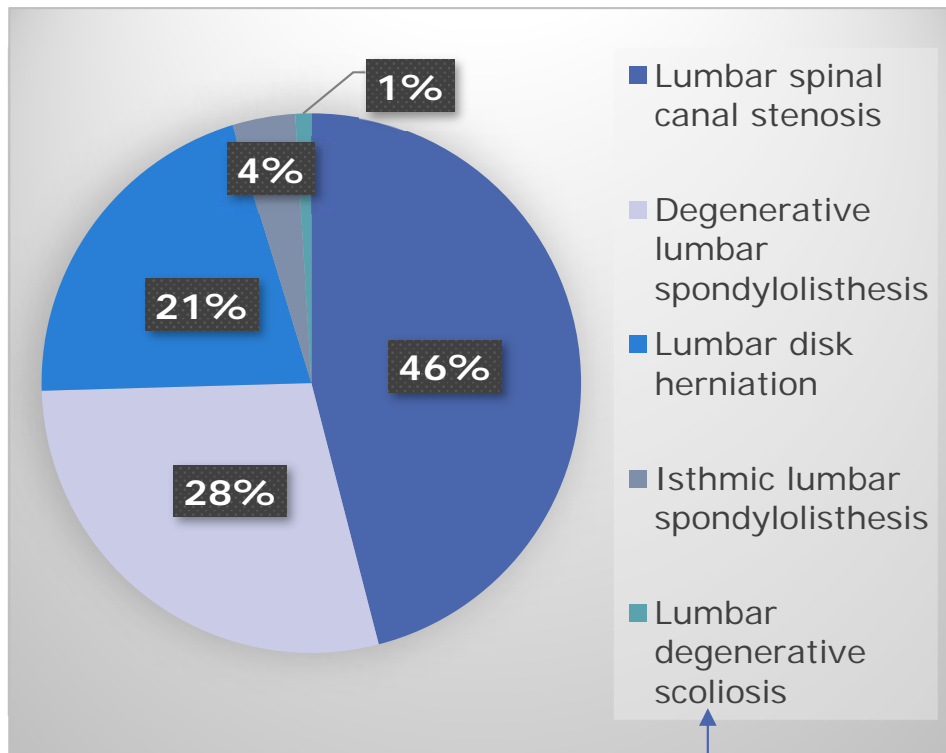
(a reduction of > 2 grades on MMT or postoperative sensory disturbance)

Perioperative systemic complication

- ✓ Cardiovascular disease
- ✓ Respiratory disease
- ✓ Gastrointestinal disease
- ✓ Renal and urological disease
- ✓ Cerebrovascular disease
- ✓ Postoperative delirium
- ✓ Sepsis
- ✓ In-hospital mortality

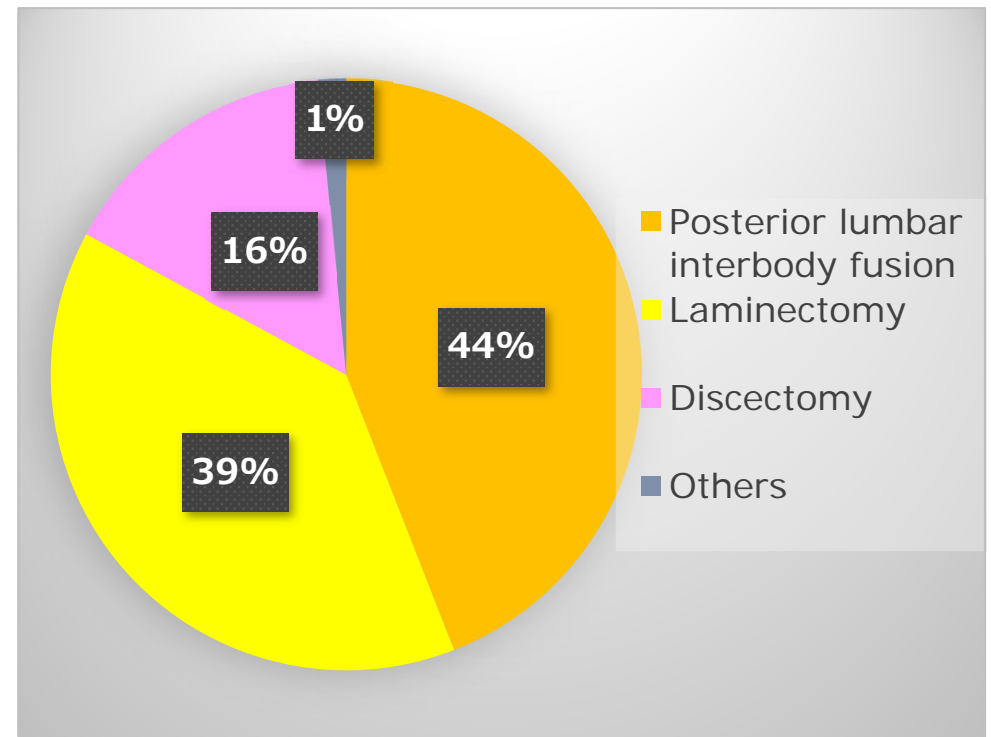
(requiring additional consultation with appropriate specialists)

Disease



without the intention to perform spinal correction

Procedure



Results

| Subject | Dural tear group | Non-dural tear group | P |
|--|---|---|-----------------|
| No. of patients | 451 | 12737 | |
| Male:female | 216 [47.9%] :235 [52.1%] | 6958 [54.6%] :5779 [45.4%] | .005 |
| Age, years (range) | 69.6 (19–94) | 66.7 (11–94) | <.001 |
| Disease distribution, LSS:DLS:LDH:ILS:LDS | 231:113:82:14:11 [51.2:25.1:18.2:3.1:2.4%] | 5833:3654:2653:482:115 [45.8:28.7:20.8:3.8:0.9%] | .004 |
| Procedure distribution, PLIF:laminectomy: discectomy:others | 187:205:50:9 [41.5:45.5:11.1:2.0%] | 5623:4917:2002:195 [44.1:38.6:15.7:1.5%] | .004 |

LSS, lumbar spinal canal stenosis; DLS, degenerative lumbar spondylolisthesis; ILS, isthmic lumbar spondylolisthesis; LDH, lumbar disk herniation; LDS, lumbar degenerative scoliosis; PLIF, posterior lumbar interbody fusion.

These variables were used in the following multivariate regression model to control for confounders.

Univariate analysis

| | Dural tear group | Non-dural tear group | P |
|--|------------------|----------------------|-----------------|
| Intraoperative surgery-related complication | | | |
| Massive hemorrhage (> 2 L) | 1 [0.2%] | 31 [0.2%] | .535 |
| Nerve injury | 2 [0.4%] | 14 [0.1%] | .102 |
| Screw malposition | 0/196 [0.0%] | 33/5761 [0.6%] | .627 |
| Cage/graft dislocation | 0/189 [0.0%] | 8/5779 [0.1%] | .999 |
| Wrong site surgery | 0 [0.0%] | 11 [0.1%] | .999 |
| Vascular injury | 0 [0.0%] | 1 [0.0%] | .999 |
| Postoperative surgery-related complication | | | |
| Dural leak | 88 [19.5%] | 30 [0.2%] | <.001 |
| Surgical site infection | 8 [1.8%] | 86 [0.7%] | .015 |
| Postoperative neurological deficit | 19 [4.2%] | 129 [1.0%] | <.001 |
| Hematoma | 7 [1.6%] | 93 [0.7%] | .086 |
| Wound dehiscence | 1 [0.2%] | 16 [0.1%] | .447 |
| Screw/Rod failure | 0/196 [0.0%] | 35/5761 [0.6%] | .345 |
| Cage/graft failure | 0/189 [0.0%] | 36/5779 [0.1%] | .629 |
| Perioperative systemic complication | | | |
| Cardiovascular disease | 1 [0.2%] | 30 [0.2%] | .999 |
| Respiratory disease | 0 [0.0%] | 13 [0.1%] | .999 |
| Gastrointestinal disease | 0 [0.0%] | 7 [0.1%] | .341 |
| Renal and urological disease | 1 [0.2%] | 30 [0.2%] | .999 |
| Cerebrovascular disease | 1 [0.2%] | 13 [0.1%] | .386 |
| Postoperative delirium | 6 [1.3%] | 49 [0.4%] | .011 |
| Sepsis | 0 [0.0%] | 3 [0.0%] | .999 |
| In-hospital mortality | 0 [0.0%] | 3 [0.0%] | .999 |

Multivariate analysis

| Dependent Variable | Independent Variable | P | OR | 95% CI |
|---|----------------------------|-------|-------|------------|
| Dural leak | Dural tear | <.001 | 111.0 | 71.4–172.4 |
| | Massive hemorrhage (> 2 L) | .002 | 20.4 | 3.11–133.4 |
| SSI | Dural tear | .009 | 2.68 | 1.29–5.61 |
| Postoperative neurological deficit | Nerve injury | <.001 | 156.1 | 51.4–73.6 |
| | Cage/graft dislocation | <.001 | 38.5 | 8.66–171.6 |
| | Screw malposition | <.001 | 37.4 | 16.8–83.0 |
| | Dural tear | .002 | 3.27 | 1.55–6.89 |
| Postoperative delirium | Cardiovascular disease | .003 | 9.91 | 2.23–44.0 |
| | Dural tear | .008 | 3.21 | 1.35–7.63 |

OR, odds ratio; DT, unintentional dural tear; SSI, surgical site infection.

A regression model controlling for age, sex, primary disease and type of procedure was used.

Discussion

Dural tear and SSI

| Authors, journal & year | Dural tear/Patient population | SSI Dural tear vs Non-dural tear | P -value OR |
|---|--|---|---|
| Puvanesarajah et al. Spine 2017 | 2052/41655 (4.9%) 65-84 years Lumbar discectomy Prospective | 2.4% vs 1.3% | <0.001 OR 1.88 (1.31-2.70) |
| Yoshihara et al. Arch Orthop Trauma Surg 2013 | 4255/67982 (6.3%) Lumbar decompression surgery Retrospective | 3.4% vs 1.8% Wound-related complication | <0.001 |
| This study | 451/13188 (3.4%) Primary lumbar surgery Prospective | 1.8% vs 0.7% | 0.015 OR 2.67 (1.28-5.52) |

- ✓ Longer operative time due to an additional procedure ? *Weber et al. Eur Spine J 2015*
- ✓ Asymptomatic pseudomeningoceles after dural tear can lead to subcutaneous cerebrospinal fluid leakage accumulation, which can also increase the possibility of SSI due to fistula formation. *Couture et al. Neurosurg Focus 2003*
- ✓ Bedrest, which is needed after patients experience dural tear, may increase the risk of perioperative complications, including SSI. *Radcliff et al. Clin Spine Surg 2016*

Dural tear and postoperative neurological deficit

We cannot conclude a causative relationship between dural tear and postoperative neurological deficit using the results of the present study and previous reports. However, the association between the two complications suggests that neural elements may be injured when the dura is penetrated intraoperatively.

McMahon et al. J Neurosurg Spine 2012
Williams et al. Neurosurgery 2011

Dural tear and postoperative delirium

| Authors, journal & year | Dural tear/Patient population | Delirium Dural tear vs Non-dural tear | P-value OR |
|-------------------------------|--|--|---|
| Kelly et al. The Spine J 2014 | 6/92 (6.5%) Degenerative lumbar spondylolisthesis prospective | NA | Age adjusted OR 35.8 (1.7-747) |
| This study | 451/13188 (3.4%) Primary lumbar surgery Prospective | 1.3% vs 0.4% | 0.011 OR 3.49 (1.49-8.19) |

Caused by the requirement for bedrest, which is necessary after dural tear ?

Conclusion

This study showed higher incidences of **SSI**, **postoperative neurological deficit**, and **postoperative delirium** in the dura tear group as well as of directly related complications, such as dural leak. Longer operative time, the need for additional procedures, and a longer postoperative bedrest duration could be related to the higher incidence of seemingly unrelated complications in patients with dura tear.

EUROSPINE 2018 COI Disclosure

Name of First Author : Shota Takenaka

The authors have no financial conflicts of interest to disclose concerning the presentation.