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Incidence, Risk Factors, and Outcomes of Incidental Durotomy during Lumbar Spine Decompression with or without Fusion

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Study Design: Retrospective cohort study.

Purpose: The primary objective of this study was to determine the incidence and risk factors for incidental durotomies during lumbar decompression surgeries. In addition, we aimed to determine the changes in patient-reported outcome measures (PROMs) based on incidental durotomy status.

Overview of Literature: There is limited literature investigating the affect of incidental durotomy on patient reported outcome measures. While the majority of research does not suggest differences in complications, readmission, or revision rates, many studies rely on public databases, and their sensitivity and specificity for identifying incidental durotomies is unknown.

Methods: Patients undergoing lumbar decompression with or without fusion at a single tertiary care center were grouped based on the presence of a durotomy. Multivariate analysis was performed for length of stay (LOS), hospital readmissions, and changes in PROMs. To identify surgical risk factors for durotomy, 3:1 propensity matching was performed using stepwise logistic regression. The sensitivity and specificity of the International Classification of Disease, 10th revision (ICD-10) codes (G96.11 and G97.41) were also assessed.

Results: Of the 3,684 consecutive patients who underwent lumbar decompressions, 533 (14.5%) had durotomies, and a complete set of PROMs (preoperative and 1-year postoperative) were available for 737 patients (20.0%). Incidental durotomy was an independent predictor of increased LOS but not hospital readmission or worse PROMs. The durotomy repair method was not associated with hospital readmission or LOS. However, repair with collagen graft and suture predicted reduced improvement in Visual Analog Scale back (β=2.56, p=0.004). Independent risk factors for incidental durotomies included revisions (odds ratio [OR], 1.73; p<0.001), levels decompressed (OR, 1.11; p=0.005), and preoperative diagnosis of spondylolisthesis or thoracolumbar kyphosis. The sensitivity and specificity of ICD-10 codes were 5.4% and 99.9%, respectively, for identifying durotomies.

Conclusions: The durotomy rate for lumbar decompressions was 14.5%. No differences in outcomes were detected except for increased LOS. Database studies relying on ICD codes should be interpreted with caution due to the limited sensitivity in identifying incidental durotomies.

Keywords: Dural tear; Cerebrospinal fluid leak; Incidental durotomy; Hospital readmission; Length of stay; Lumbar spine; Patient-reported outcome measures

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Introduction

The reported incidences of incidental durotomies (0.5%–18%) or "dural tears" are highly variable, likely due to differences in surgical complexity and patient-specific risk factors [1-5]. Not mentioning the durotomy in the operative notes or failure to include an International Classification of Diseases (ICD) code for durotomy repair may also contribute to the wide range of reported durotomy incidences [6-8]. Definitive management of durotomies often includes primary surgical repair with nonabsorbable suture [9]. Recently, new technologies have become available, including fat or muscle xenografts, collagen patches, fibrin glue, or other synthetic sealants [10-12].

Several studies showed that hospital stays are 150%–200% longer and readmission rates are almost doubled after lumbar spine surgeries complicated by dural tears [5,6,12,13]. A retrospective study reported no changes in complications, readmissions, or revision rates due to incidental durotomies [14]. However, investigations into the effects of dural tears on patient-reported outcomes are limited. One study of patient outcomes demonstrated that intraoperative incidental durotomies resulted in more residual leg pain, inferior mental health quality of life, and greater disability compared with no durotomies [5]. However, other studies have reported minimal to no differences in pain, quality of life, or disability 1 year after surgery [8,15,16].

Understanding the risk factors and postoperative outcomes after incidental durotomies in patients undergoing lumbar decompression with or without fusion is important. Thus, the purpose of this study was to determine the incidence and risk factors for incidental durotomies during lumbar decompressions with or without fusion and the proportion of incidental durotomies documented by the International Classification of Disease, 10th revision (ICD-10) codes. Changes in patient-reported outcome measures (PROMs) due to durotomies and the repair methods were also determined.

Materials and Methods

1. Data collection and study design

This study was exempt from informed consent from the institutional review board (IRB) due to its retrospective nature and low risk to subjects. After IRB approval (Thomas Jefferson University, Control #19D.508), a retrospective review of electronic medical records was conducted for patients who underwent lumbar decompression from April 2017 to May 2021 using the current procedural terminology codes (63005, 63012, 63017, 63030, 63042, 63047, or 63056). Sixteen fellowship-trained orthopedic spine surgeons performed the surgeries. Patient demographics, surgical characteristics, surgical outcomes, and preoperative and 1-year postoperative PROMs were collected, including the Oswestry Disability Index (ODI), the Short-Form 12 Physical Component (PCS-12), the Mental Component (MCS-12), and Visual Analog Scale (VAS) back and leg pain scores (OBERD, Columbia, MO, USA).

Due to the suspected low rates of incidental durotomy reporting and the inaccuracies in ICD-10 classifications, intraoperative incidental durotomies were determined using our institution's surgical equipment log. Intraoperative durotomies were defined as surgical cases using specialty equipment specifically for incidental durotomy repairs performed by orthopedic spine surgeons, as the neurosurgical department also performs intradural procedures. The specialty equipment included specialized sutures, dural sealant, and collagen-based grafts. While other repair methods exist, including fibrin glue and muscle or fat xenografts, our surgeons did not utilize these methods. Moreover, all orthopedic spine surgeons at our institution repair incidental durotomies with these techniques regardless of the tear severity. Diagnosis of intraoperative incidental durotomy was also determined using the ICD-10 codes, including G96.11 and G97.41.

2. Statistical analysis

Patients were grouped based on the presence or absence of an intraoperative incidental durotomy. A delta value (Δ) was calculated for each PROM by subtracting the preoperative value from the 1-year postoperative value. Continuous data were reported as means and standard deviations. Categorical data were compared with chi-square tests. Intragroup comparisons were performed using paired *t*-tests. The presence of an incidental durotomy and other patient demographics (age, sex, body mass index [BMI], and Charlson comorbidity index [CCI]) were categorized as independent variables in the logistic regression analysis for hospital readmissions, the Poisson regression analysis for the length of hospital stay, and the linear regression for ΔPROMs.

To identify independent surgical risk factors for incidental durotomies while accounting for differences in patient demographics, a 3:1 propensity-matched analysis was conducted controlling for age, sex, BMI, smoking status, and CCI. Patients without intraoperative incidental durotomies were matched in a 3:1 fashion to patients who underwent intraoperative incidental durotomies. Stepwise logistic regression analysis was performed to identify significant surgical variables associated with intraoperative incidental durotomies. For ICD-10 codes, sensitivity and specificity were reported compared to the specialty equipment log. A $p<0.05$ was considered statistically significant. All statistical analyses were performed using RStudio ver. 4.0.2 (RStudio, Boston, MA, USA).

Results

1. Demographics and preoperative diagnoses

Of the 3,684 consecutive patients who underwent lumbar decompressions, 2,424 underwent instrumented fusion (65.8%), and 533 patients experienced intraoperative incidental durotomies (14.5%). The patients who experienced durotomies were older (63.5 years versus 59.4 years, $p<0.001$), had a higher American Society of Anesthesiologists classification (2.44 versus 2.33, $p=0.002$), and were more likely to be diagnosed with spondylolisthesis, spinal stenosis, or thoracolumbar kyphosis (Table 1).

2. Surgical characteristics and outcomes

Patients with incidental durotomies were more likely to undergo fusions (70.0% versus 65.1%, $p=0.031$) or revision procedures (30.2% versus 18.3%, $p<0.001$). They also had a greater number of fused levels (2.47 versus 2.05, $p<0.001$) and decompressed levels (2.40 versus 1.88, $p<0.001$). Operative times (254 minutes versus 189 minutes, $p<0.001$) and lengths of hospital stay (3.88 days versus 2.98 days, $p<0.001$) were longer in patients who experience durotomies. No differences in length of follow-up, return to the operating room, or hospital readmissions were detected between the groups (Table 2).

3. Patient-reported outcomes

Preoperative and 1-year postoperative PROMS were recorded for 737 patients (20.0%). The demographics of patients who did and did not complete PROMs were similar

Table 1. Patient demographics and surgical characteristics based on presence of an intraoperative incidental durotomy

Characteristic	No durotomy (N=3,151)	Incidental durotomy (N=533)	*p*-value
Age (yr)	59.4±14.0	63.5±12.3	<0.001*
Sex			0.782
Female	1,490 (47.3)	248 (46.5)	
Male	1,661 (52.7)	285 (53.5)	
Body mass index (kg/m²)	30.3±6.38	30.5±6.12	0.281
Smoking status			0.096
Current smoker	612 (19.4)	89 (16.7)	
Former smoker	847 (26.9)	165 (31.0)	
Non-smoker	1,692 (53.7)	279 (52.3)	
Follow-up (yr)	1.06±0.96	1.06±0.90	0.404
Charlson comorbidity index	0.72±1.13	0.79±1.18	0.192
ASA classification	2.33±0.76	2.44±0.71	0.002*
Preoperative diagnosis			
Degenerative disc disease	76 (2.41)	12 (2.25)	0.429
Spondylolisthesis	1,184 (37.6)	226 (42.4)	0.038*
Stenosis	2,240 (71.1)	425 (79.7)	<0.001*
Herniation	763 (24.2)	89 (16.7)	<0.001*
Scoliosis	251 (7.97)	56 (10.5)	0.060
Radiculopathy	626 (19.9)	78 (14.6)	0.005*
Kyphosis	73 (2.32)	35 (6.57)	<0.001*
Spinal cord injury/trauma	10 (0.32)	0	0.375
Infection	39 (1.24)	4 (0.75)	0.453
Fracture	45 (1.43)	12 (2.25)	0.217
Nonunion	106 (3.36)	18 (3.38)	1.000

Values are presented as mean±standard deviation or number (%).
ASA, American Society of Anesthesiologists.
*$p<0.05$ (statistical significance).

(Supplement 1). Outcomes and surgical characteristics were similar to those of the entire cohort. Incidental durotomies were not significantly different among patients with and without complete PROMs (16.1% versus 14.1%, respectively). No significant intergroup differences were detected between patients with and without durotomies in preoperative, 1-year postoperative, or delta PROMs, except for preoperative ODI (48.1 versus 43.3, $p=0.025$) (Table 3).

4. Dural repair method

Of the 533 incidental durotomies, dural sealant was utilized in most repairs (88.7%). Sutures were utilized in 232 repairs (43.5%) and collagen grafts were utilized in

Table 2. Surgical outcomes based on presence of an intraoperative incidental durotomy

Variable	No durotomy (N=3,151)	Incidental durotomy (N=533)	*p*-value
Surgical approach			0.747
Anterior	24 (0.76)	3 (0.56)	
Combined	549 (17.4)	86 (16.1)	
Posterior	2578 (81.8)	444 (83.3)	
Fusion procedure	2051 (65.1)	373 (70.0)	0.031*
No. of levels fused	2.05±2.02	2.47±2.42	<0.001*
No. of levels decompressed	1.88±1.39	2.40±1.74	<0.001*
Revision procedure	578 (18.3)	161 (30.2)	<0.001*
Operative time (min)	189±114	254±131	<0.001*
Length of stay (day)	2.98±4.34	3.88±2.98	<0.001*
Return to operating room	40 (1.27)	12 (2.25)	0.076
Hospital readmission	197 (6.25)	36 (6.75)	0.731
30-Day readmission	126 (4.00)	20 (3.75)	0.881
90-Day readmission	71 (2.25)	16 (3.00)	0.374
Estimated blood loss (mL)	257±383	362±425	<0.001*
Postoperative drain usage	898 (28.5)	179 (33.6)	0.020*
Drain duration (day)	2.41±1.10	2.79±1.36	0.001*
Drain output (mL)	572±430	658±395	0.002*
Repair method			
Suture±dural sealant	-	232 (43.5)	
Collagen-based graft±dural sealant	-	281 (52.7)	
Only dural sealant	-	144 (27.0)	
Combination±dural sealant	-	124 (23.3)	

Values are presented as number (%) or mean±standard deviation.
*$p<0.05$ (statistical significance).

Table 3. Patient-reported outcomes based on the presence of an intraoperative incidental durotomy

Variable	Category	No durotomy (N=622)	Incidental durotomy (N=116)	*p*-value
ODI	Preoperative	48.1±17.2	43.3±19.1	0.025*
	1-Year postoperative	26.9±20.6	22.7±19.0	0.055
	Δ	-21.16±21.4	-20.66±20.9	0.825
	Intragroup *p*-value	<0.001*	<0.001*	
VAS back	Preoperative	6.32±2.81	6.12±3.03	0.709
	1-Year postoperative	3.50±2.83	3.23±2.70	0.370
	Δ	-2.82±3.40	-2.90±3.07	0.962
	Intragroup *p*-value	<0.001*	<0.001*	
VAS leg	Preoperative	6.67±2.70	6.81±2.75	0.465
	1-Year postoperative	3.04±3.01	2.86±2.86	0.981
	Δ	-3.62±3.80	-3.96±3.54	0.442
	Intragroup *p*-value	<0.001*	<0.001*	
MCS-12	Preoperative	47.8±11.3	48.7±11.1	0.492
	1-Year postoperative	50.6±11.1	51.7±10.1	0.518
	Δ	2.83±11.7	2.91±11.7	0.947
	Intragroup *p*-value	<0.001*	0.052	
PCS-12	Preoperative	30.1±7.84	31.0±9.08	0.614
	1-Year postoperative	37.9±10.9	39.4±10.7	0.145
	Δ	7.79±11.1	8.43±11.0	0.515
	Intragroup *p*-value	<0.001*	<0.001*	

Values are presented as mean±standard deviation, unless otherwise stated.
ODI, Oswestry Disability Index; VAS, Visual Analog Scale; MCS-12, Mental Health Component Score; PCS-12, Physical Health Component Score; Δ, 1-year postoperative value minus the preoperative value.
*$p<0.05$ (statistical significance).

281 (52.7%). Collagen grafts±dural sealant were used in 157 repairs (29.5%), sutures±dural sealant were used in 108 repairs (20.3%), a combination of collagen grafts and sutures ± dural sealant were used in 124 repairs (23.3%), and dural sealant without collagen grafts or sutures was used in 144 repairs (27.0%). No significant differences in return to the operating room (p=0.214) or total operative time based on repair technique (p=0.069) were detected.

5. Multivariate regression analysis

The presence of intraoperative incidental durotomies was not an independent predictor of increased hospital readmission (odds ratio [OR], 1.02; p=0.915) or decreased improvement in ΔPROMs (ΔODI: β=0.111, p=0.962; ΔVAS back: β=−0.02, p=0.960; ΔVAS leg: β=−0.42, p=0.307; ΔMCS-12: β=0.14, p=0.912; and ΔPCS-12: β=1.06, p=0.377). However, intraoperative incidental durotomy was an independent predictor of prolonged hospital stays (incidence rate ratio [IRR], 1.19; p<0.001).

Age and BMI were independent predictors of prolonged hospital stays (IRR, 1.02; p<0.001 and IRR, 1.01; p<0.001, respectively). Male sex was an independent predictor of decreased lengths of hospital stay (IRR, 0.92; p<0.001) and an independent predictor of decreased improvement in ΔPCS-12 (β=−2.29, p=0.010). CCI was an independent predictor of increased hospital readmissions (OR, 1.13; p=0.029), increased length of hospital stays (IRR, 1.13; p<0.001), and decreased improvement in ΔODI (β=2.43, p=0.009), ΔVAS leg (β=0.49, p=0.003), and ΔPCS-12 (β=−1.28, p=0.006) (Tables 4, 5).

The incidental durotomy repair method was not an

Table 4. Multivariate regression for hospital readmission and length of stay

Variable	Hospital readmission		Length of stay (day)	
	Odds ratio (95% CI)	*p*-value	Incidence rate ratio (95% CI)	*p*-value
Incidental durotomy	1.02 (0.69–1.47)	0.915	1.19 (1.14–1.25)	<0.001*
Age (yr)	1.01 (1.00–1.02)	0.153	1.02 (1.02–1.02)	<0.001*
Sex (male)	0.94 (0.72–1.23)	0.644	0.92 (0.89–0.96)	<0.001*
Body mass index	1.01 (0.99–1.03)	0.347	1.01 (1.01–1.02)	<0.001*
Charlson comorbidity index	1.13 (1.01–1.25)	0.029*	1.13 (1.12–1.15)	<0.001*

CI, confidence interval.
*$p<0.05$ (statistical significance).

Table 5. Multivariate regression for Δ patient-reported outcome measures

Variable	ΔODI		ΔVAS back		ΔVAS leg		ΔMCS-12		ΔPCS-12	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
Incidental durotomy	0.11	0.962	-0.02	0.960	-0.42	0.307	0.14	0.912	1.06	0.377
Age (yr)	0.08	0.246	-0.02	0.146	0.00	0.684	-0.00	0.947	-0.04	0.250
Sex (male)	0.54	0.761	0.32	0.246	0.13	0.681	0.19	0.843	-2.29	0.010*
Body mass index	0.22	0.128	0.00	0.954	-0.02	0.512	0.02	0.789	-0.14	0.051
Charlson comorbidity index	2.43	0.009*	0.20	0.173	0.49	0.003*	-0.84	0.098	-1.28	0.006*

ODI, Oswestry Disability Index; VAS, Visual Analog Scale; MCS-12, Mental Health Component Score; PCS-12, Physical Health Component Score; Δ, 1-year postoperative value minus the preoperative value.
*$p<0.05$ (statistical significance).

Table 6. Regression for hospital readmission and length of stay based on method of intraoperative incidental durotomy repair

Variable	Hospital readmission		Length of stay (day)	
	Odds ratio (95% CI)	*p*-value	Incidence rate ratio (95% CI)	*p*-value
Collagen graft repair±dural sealant	Ref	-	Ref	-
Suture repair±dural sealant	1.54 (0.62–3.88)	0.346	0.92 (0.81–1.04)	0.190
Combination repair±dural sealant	0.98 (0.36–2.59)	0.961	0.98 (0.87–1.11)	0.753
Only dural sealant	0.63 (0.21–1.77)	0.393	0.90 (0.80–1.01)	0.078
Age (yr)	1.03 (0.99–1.06)	0.134	1.01 (1.01–1.01)	<0.001*
Sex (male)	0.98 (0.48–1.99)	0.952	0.85 (0.78–0.93)	<0.001*
Body mass index	1.04 (0.98–1.10)	0.210	1.01 (1.00–1.02)	0.032*
Charlson comorbidity index	1.15 (0.87–1.46)	0.280	1.11 (1.07–1.15)	<0.001*

CI, confidence interval; Ref, reference.
*$p<0.05$ (statistical significance).

independent predictor of hospital readmissions or length of hospital stay (Table 6). However, repair with both collagen graft and suture independently predicted decreased improvement in ΔVAS back ($\beta=2.56$, $p=0.004$) (Table 7).

6. Surgical risk factors

Following a 3:1 demographic cohort match (Supplement 2), a stepwise logistic regression identified revision procedures (OR, 1.73; $p<0.001$) and the number of levels decompressed (OR, 1.11; $p=0.005$) as independent risk factors for intraoperative incidental durotomies. Additionally, preoperative diagnoses of spondylolisthesis (OR, 1.31; $p=0.049$) or thoracolumbar kyphosis (OR, 1.87; $p=0.013$) were independent risk factors for intraoperative incidental durotomies.

Table 7. Multivariate regression for Δ patient-reported outcome measures based on method of intraoperative incidental durotomy repair

Variable	ΔODI		ΔVAS back		ΔVAS leg		ΔMCS-12		ΔPCS-12	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
Collagen graft repair±dural sealant	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-
Suture repair±dural sealant	-7.67	0.311	-0.36	0.723	-0.36	0.775	1.34	0.737	-4.45	0.222
Combination repair±dural sealant	3.11	0.622	2.56	0.004*	0.08	0.939	-3.02	0.398	-4.56	0.163
Only dural sealant	-3.12	0.591	0.48	0.546	0.10	0.922	0.54	0.865	-3.33	0.256
Age (yr)	0.08	0.659	0.01	0.760	-0.00	0.880	0.01	0.898	-0.00	0.962
Sex (male)	4.68	0.309	-0.02	0.970	-0.07	0.931	1.29	0.612	-0.72	0.755
Body mass index	-0.12	0.739	0.02	0.730	-0.04	0.543	-0.20	0.324	-0.20	0.276
Charlson comorbidity index	3.07	0.212	0.13	0.697	0.19	0.654	0.72	0.617	-1.55	0.238

ODI, Oswestry Disability Index; VAS, Visual Analog Scale; MCS-12, Mental Health Component Score; PCS-12, Physical Health Component Score; Δ, 1-year postoperative value minus the preoperative value; Ref, reference.
*p<0.05 (statistical significance).

7. Documentation of incidental durotomies

Of 3,684 total patients with 533 incidental durotomies (14.5%) based on equipment logs, the ICD-10 codes were listed for only 32 patients (0.87%). Therefore, ICD code sensitivity was 5.4% and specificity was 99.9%.

Discussion

Our retrospective cohort of 3,684 lumbar decompressions with and without fusions demonstrated an incidental durotomy rate of 14.5%. Risk factors for incidental durotomies included revision procedures, the number of surgical levels decompressed, and a preoperative diagnosis of spondylolisthesis or kyphosis. Intraoperative incidental durotomies were not independent predictors of increased hospital readmissions or worse ΔPROM improvement but did predict longer hospital stays. Dural repair with a combination of collagen graft and sutures was a significant independent predictor of decreased improvement in the 1-year postoperative VAS back compared to other dural repair methods, which may reflect worse outcomes in patients with more severe tears.

The rate of incidental durotomies in our study was similar to a prospective study of 76 patients undergoing lumbar spinal surgery at an academic center (15.8%) and a multicenter database study of 564 patients undergoing adult spinal deformity surgery (12.1%) [17,18]. Significant variability in durotomy incidence may be due to the procedure type, as discectomies and single-level procedures are lower risks than laminectomies and multi-level procedures [4]. Additionally, lower incidental durotomy rates are reported in database studies, including PearlDiver, which reported a 2.8% incidence of durotomies [6]. The lower rates may be due to a reliance on ICD codes, which have a sensitivity of only 5.4% in our analysis. A multicenter retrospective cohort study of 2,146 patients undergoing lumbar laminectomy reported an incidental durotomy rate of 7.7%, which was determined via a postoperative surgeon questionnaire [8]. A 2015 systematic review reported an incidental durotomy rate of 9.57% in prospective studies, but only 4.52% in retrospective studies [19]. These reports increase the validity of our incidence rate and support the finding that utilizing ICD codes may be underestimate durotomy rates.

The Spine Patient Outcomes Research Trial (SPORT), a multicenter prospective randomized controlled trial, reported an incidental durotomy rate of 9.0% in primary procedures for spinal stenosis [7]. Our study was conducted at a tertiary academic center, which may explain the higher incidental durotomy incidence, given the relatively high rate of complex spondylolisthesis and deformity cases and the involvement of trainees [8]. We also identified an increased incidence among patients with thoracolumbar kyphosis consistent with an analysis by Iyer et al. [18], who reported that patients with reduced lumbar lordosis are at greater risk of incidental durotomy. Patients undergoing spinal fusions for deformities are more likely to require osteotomies, which may independently increase the risk of incidental durotomies [18]. These deformities present on a continuum, and more severe diseases may require more aggressive correction yielding greater durotomy rates. Thus, future research evaluating the severity of spinal pathology on the risk of incidental durotomy is indicated.

Revision surgery is an important risk factor for incidental durotomy [4,8,16,18,20,21]. Prior lumbar surgery causes fibrosis and scar tissue formation, which adheres to the dura and complicates the separation of the two layers [22]. Our study supports this finding; revision surgery was an independent predictor associated with a 73% increased risk of incidental durotomy. In addition, each level decompressed incurred an 11% increased risk of incidental durotomy, and spondylolisthesis or thoracolumbar kyphosis increased the risk of durotomy by 31% and 87%, respectively. These risk factors were previously identified [4,8,18,23].

Increasing age was associated with incidental durotomies with a mean difference of approximately 4 years according to the univariate analysis. Increasing age is a known risk factor for incidental durotomies due to the normal aging process, including spinal canal narrowing, ligamentum flavum hypertrophy, osteophyte formation, and shortening of the spine leading to redundant dura [4,18,20,21,24]. While thickened dura protects against tearing, the fibrous degenerative changes during the aging process lead to friability and less elasticity, rendering the dura more prone to injury. Dural redundancy increases trapping of the Kerrison rongeur. BMI also correlates with incidental durotomy rates [4]. However, this is not a universal finding. A recent meta-analysis of eight studies including 11,416 patients found no association between incidental durotomy and BMI, in agreement with our findings [21].

Possible explanations for the disparate durotomy rates between our study and previous database studies include increased sample sizes in database studies and limitations inherent to database analysis, which are reliant on accurate ICD coding. ICD codes grossly underrepresented the true incidence of incidental durotomies with a sensitivity of only 5.4%. The inaccuracy of ICD codes may be due to medicolegal implications. The underestimation severely limits the validity of database studies focused on the rates and predictors of incidental durotomies [25]. The limitations of ICD codes and database studies have been demonstrated by previous orthopedic studies [26-28].

The effects of incidental durotomies on postoperative PROMs have been the focus of many studies. A subset of 409 patients from the SPORT who underwent lumbar decompression, a separate retrospective cohort analysis of 2,907 lumbar surgery patients, and a retrospective cohort of 564 patients undergoing adult deformity surgery all found no significant differences in postoperative outcomes due to incidental durotomies [7,16]. A systematic review and meta-analysis of 11 studies, including over 65,000 patients, found only marginally diminished improvements in ODI and VAS leg in patients with intraoperative incidental durotomies but did not control for patient demographics with possible confounding outcomes between patient cohorts [15]. Our study largely supports these studies, incidental durotomies were not independent predictors of ΔPROMs in the multivariate analysis.

Different techniques for incidental durotomy repair are effective, although a meta-analysis of 49 studies demonstrated suture repair has a lower rate of failure than indirect repair [1]. In our study, incidental durotomy repair technique did not alter the length of stay or rate of hospital readmission in the multivariate analysis. Interestingly, patients with intraoperative incidental durotomy that were repaired with both collagen-based grafts and non-absorbable sutures had significantly worse improvements in VAS back in the multivariate analysis. To the authors' knowledge, this relationship was not previously demonstrated. This finding may be related to the severity of the incidental durotomy, as patients with larger dural tears may require more intricate dural repairs. The dural repair equipment is subject to provider preference; thus, strong conclusions cannot be made regarding the role of the technique, which may be confounded by dural tear severity. Future research into the severity of intraoperative incidental durotomies is warranted to determine if a threshold exists at which intraoperative incidental durotomy may lead to diminished postoperative improvement.

Limitations of our study include those inherent to retrospective research. However, multivariate regression analyses and matching limited the confounding variables. We included numerous preoperative diagnoses but the severity and complications of diagnoses, such as the presence of a facet cyst, were not collected. Due to limitations in the availability of magnetic resonance imaging and preoperative radiographs permanently saved in our PACS, we were unable to determine if the degree of stenosis, kyphosis, or spondylolisthesis was associated with incidental durotomies. Another limitation is the rate of incomplete PROMs. We only included patients with a complete set of preoperative and 1-year postoperative PROMs, which allowed for a complete, balanced analysis. While bias may exist in this study due to the high percentage of incomplete PROMs, the rate of incidental durotomies and other patient demographics did not differ between these populations, limiting this potential bias. Equipment logs were utilized to determine the incidence of intraoperative incidental durotomies, which may be subject to inaccuracies if the product was incorrectly pulled. However, this method is superior to ICD codes utilized in large incidental durotomy database studies. Additionally, minor tears may not have been identified by the surgeon and did not require incidental durotomy repair kits. However, using ICD codes would also fail to capture the incidence of these tears. Furthermore, our study evaluated PROMs postoperatively for 1 year, but we were unable to determine if incidental durotomies influenced long-term outcomes and only a minority of patients were represented due to limitations in collecting both preoperative and 1-year postoperative PROMs.

Conclusions

A retrospective review of patients undergoing lumbar decompression with or without fusion revealed an incidental durotomy rate of 14.5%. Incidental durotomies prolonged hospital stays but did not increase hospital readmissions or alter PROM improvements. Additional research aimed at identifying if incidental durotomy severity impacts clinical outcomes is warranted given that patients with durotomies repaired with sutures and collagen-based grafts had diminished postoperative improvement in VAS back. Finally, database studies relying on ICD codes should be interpreted with caution due to their limited sensitivity in reporting dural tear incidence.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Supplementary Materials

Supplementary materials can be available from https://doi.org/10.31616/asj.2022.0297. Supplement 1. Patient demographics and surgical characteristics among patients with complete patient-reported outcome measures. Supplement 2. Patient demographics and surgical characteristics of matched patient cohort.

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