Journal of Clinical Neuroscience xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Case study

Outcomes of thoracic discectomy: A single center retrospective series

Michael Cloney *, Benjamin Hopkins, Ekamjeet Dhillon, Nader S Dahdaleh

Department of Neurological Surgery, Northwestern University, Feinberg School of Medicine, Chicago, Illinois, United States

1. Introduction

Disc herniation is among the most common causes of radiculopathy and myelopathy [1,2]. The most common locations include lumbar and the cervical spine due to their mobility [2]. Disc herniation in the thoracic spine, however, is a relatively rare occurrence, with an estimated incidence of approximately 1 per million patients [3,4]. It is further reported that disc herniation of the thoracic spine accounts for as few as 0.1–4% of all spinal disc herniation cases [3,5,6]. As such, literature on the topic remains scarce, and is confined to case reports and small clinical series, with emphasis on novel surgical approaches and diagnostic workup [3,6–17].

Managing thoracic disc herniation can be challenging, therefore there is little consensus regarding which approach should be recommended for surgical treatment of thoracic disc herniations [18–23]. Initially, thoracic laminectomy was the preferred approach, but has since fallen out of favor due to poor associated outcomes [24–27]. Subsequently, numerous techniques have been developed, but there is debate about which technique should be used [18–20,22,23]. While existing literature has focused on surgical technique, little has been reported concerning risk factors and complications associated with thoracic disc herniation and discectomy, with only a few series published to date [3,28–30].

The current study follows a large, consecutive series of patients undergoing discectomy at a single institution to identify differences in baseline patient characteristics, management, and outcomes for patients undergoing thoracic discectomy versus those undergoing discectomy of the lumbar or cervical regions.

2. Methods

2.1. Data source

All patients who underwent spine surgery in the Departments of Neurological Surgery or Orthopedic Surgery of Northwestern University between January 1st, 2009 and May 31st, 2015 were identified using the Northwestern University Electronic Data Warehouse (EDW). The EDW is a clinical data repository jointly funded by Northwestern Memorial Hospital (NMH), Northwestern Medical Faculty Foundation (NMFF), and Northwestern University Feinberg School of Medicine. Spine surgeries were detected using Current Procedural Technology (CPT) codes, and all identified primary spine surgeries were included in the analysis. If patients had multiple procedures requiring different admissions during this timeframe, each operation was analyzed separately. We excluded any patients undergoing minor spine surgeries (including electrode placements or hardware removal) or secondary procedures (operations for wound dehiscence and hematoma evacuations). For each spine surgery included in the study, data was collected about the patient, the procedure, and the post-operative management and recovery. The study was approved by Northwestern's Institutional Review Board (IRB).

2.2. Patient data

We collected the following patient data: age at surgery, gender, body mass index (BMI), smoking status (never, current, quit <1 year ago), race (Caucasian, African American, Hispanic, Pacific Islander, Other), history of VTEs, history of bleeding disorders, and number of comorbidities present (hypertension, cardiac, renal, pulmonary, and endocrine disease), as identified by the ninth edition of International Classification of Disease (ICD-9) codes.

2.3. Procedure data

We collected the following data about the procedures performed: site of surgery (cervical, thoracic, lumbar, other), whether a fusion was part of the procedure, whether the procedure included fusion or corpectomy, whether the surgery was performed minimally invasively, whether the surgery was staged across multiple days, prophylactic IVC filter placement, length of surgery (minutes), and length of anesthesia (minutes).

2.4. Outcomes data

We collected data on estimated blood loss (EBL) in mL, the use of red blood cell (RBC) transfusion, the amount RBCs transfused in mL, ICU admission, and length of hospitalization (days). We also collected information about complications within 30 days after the surgery included the cumulative 30-day incidence and timing of VTEs (defined as either DVT or PE), cumulative 30-day incidence and timing of epidural hematomas, cumulative 30-day incidence of post-epidural hematoma neurological deficit, all-cause readmissions, reoperations, and death.

* Corresponding author at: Department of Neurological Surgery, Northwestern University, Feinberg School of Medicine, Chicago, Illinois, United States.

E-mail address: michael.cloney@yahoo.com (M. Cloney).

https://doi.org/10.1016/j.jocn.2017.10.013

Table 1
Comparisson of procedural and pathological characterisitics for Thoracic v. Other discectomy.

	Thoracic Region (n = 37)	Other Regions (n = 3462)	Univariate			Multivariate		
			OR	95% CI	P-value	OR	95% CI	P-value
Fusion	29.7%	30.8%	0.95	[0.47, 1.94]	.8923	0.24	[0.11, 0.52]	<.001
Corpectomy	5.4%	1.0%	5.60	[1.30, 24.18]	.0093	–	–	–
Neuromonitoring	100.0%	46.3%	86.97	[5.33, 1418]	<.0001	–	–	–
Scoliosis	2.7%	0.3%	7.99	[1.04, 58.48]	.0191	6.58	[0.78, 55.40]	.083
Stenosis	10.8%	9.8%	1.11	[0.39, 3.15]	.8454	–	–	–
Osteomyelitis	0.0%	0.7%	1.95	[0.12, 32.75]	.6189	–	–	–
MIS	18.9%	35.0%	0.43	[0.19, 0.99]	.0407	1.02	[1.01, 1.10]	.026
Fracture	0.0%	0.3%	4.85	[0.28, 84.89]	.7562	–	–	–

Comparisson of procedural and pathological characterisitics for Thoracic v. Other discectomy. Variables that did not approach significance on multivariable regression are not shown in the multivariable analysis column. Neuromonitoring: intraoperative neuromonitoring, e.g., SSEP, MEP. MIS: minimally invasive surgery.

2.5. Statistical methods

Microsoft Excel 2011 (Microsoft, Redmond, WA, USA) was used to manage data. Prism 6.0b (GraphPad Software, Inc., La Jolla, CA, USA) and Stata 12.0 (StataCorp, College Station, TX, USA) were used to conduct all statistical analysis. Parametric data was given as m ean ± standard deviation and compared by the Student *t* Test, and non-parametric data was compared using Mann-Whitney *U* test or Chi-square tests, as appropriate. 95% confidence intervals were calculated as appropriate. Time-to-event data was analyzed using Mantel-Cox statistics. Stepwise, forward, multiple variable logistic regressions were performed with all candidate variables to identify independent associations with the outcomes of interest. Candidate variables included all of the above stated patient data variables and procedure data variables. A threshold of $p \leq .10$ was used for inclusion in the multiple variable regression models. A value of $P < .05$ was considered statistically significant.

3. Results

3.1. Baseline patient characteristics

3499 consecutive discectomy procedures were identified that met the above criteria, with 37 of them undergoing thoracic discectomy. Compared to patients with non-thoracic disc disease, patients undergoing thoracic discectomy had higher average BMI (30.8 ± 1.4 v. 28.2 ± 0.1, Δ = 2.6 ± 1.1, p = .0162), were more likely to have multiple comorbid diseases (≥2 comorbid diagnoses, p = .0260), and were more likely to have an IVC filter in place prior to surgery (8.8% v. 0.4%, OR 23.83 [6.568, 72.49], p < .0001). There was no difference between the two groups with respect to age (51. 5 ± 2.5 years v. 48.3 ± 0.2 years, Δ = 3.2 ± 2.5, p = .1978), gender (41.2% female v. 43.6% female, OR 1.103 [0.556, 2.190], p = .7804), cancer history (32.4% v. 30.2%, OR 0.8995 [0.4501, 1.797], p = .7641), smoking status (18.9% v. 17.0%, OR 0.8804 [0.3848, 2.014], p = .7628), insurance type (p = .2188), and race (p = .5470). On multivariable regression, patients undergoing thoracic discectomy had higher BMI (OR 1.052 [1.006, 1.099], p = .026), and were more likely to have an IVC filter in place (OR 22.380 [6.048, 82.817], p < .0001).

3.2. Procedure characteristics

Thirty (81.1%) of the surgical approaches for the 37 patients with thoracic disc disease were posterior approaches, 4 (10.8%) were anterior approaches, and 3 (8.1%) were lateral approaches. Eight procedures (21.6%) were endoscopic, 5 (13.5%) were transpedicular, and 1 (2.7%) was performed via sternotomy. Two patients (5.4%) simultaneously underwent corpectomy, 11 (29.7%) had fusions, and 4 (10.8%) underwent facetectomy or foraminotomy.

Table 2
Negative outcomes associated with thoracic discectomy.

Outcome	OR	95% CI	P-value
Transfusion	8.66	[1.19, 63.03]	.033
DVT	117.34	[15.98, 862.35]	<.001
ICU admission	5.40	[1.20, 24.18]	.028
Reoperation	9.27	[0.79, 109.25]	.077

Negative outcomes that were independently associated with thoracic discectomy on multivariable regression. DVT: deep venous thrombosis. ICU: intensive care unit.

3.3. Comparison of procedural and pathological characteristics

Patients undergoing thoracic discectomy were more likely to undergo intraoperative neuromonitoring (100% v. 46.3%, OR 86.97 [5.333, 1418], p < .0001), or corpectomy (5.4% v. 1.0%, OR 5.595 [1.295, 24.18], p = .0093), and were less likely to undergo a minimally invasive procedure (18.9% v. 35.0%, OR 0.4326 [0.1894, 0.9880], p = .0407) (Table 1). They were more likely to carry a diagnosis of scoliosis (2.7% v. 0.3%, OR 7.988 [1.040, 58.48], p = .0191). There was no difference between thoracic and non-thoracic discectomy patients with respect to the use of fusions (29.7% v. 30.8%, OR 0.9522 [0.4687, 1.935], p = .8923), and the two groups were equally likely to have discitis or osteomyelitis (0% v. 0.7%, OR 1.951 [0.1163, 32.75], p = .6189), stenosis (10.8% v. 9.8%, OR 1.109 [0.3906, 3.151], p = .8454), and a fracture (0% v. 0.3%, OR 4.848 [0.2769, 84.89], p = .7562). On multivariable regression, thoracic discectomy patients were less likely to undergo fusion (OR 0.238 [0.109, 0.519], p < .001), and showed a trend toward an increased likelihood of carrying the diagnosis of scoliosis (OR 6.583 [0.782, 55.40], p = .083).

3.4. Thoracic discectomy as a predictor of negative outcomes

Among patients undergoing discectomy, thoracic discectomy was an independent predictor of transfusion (OR 8.660 [1.190, 63.027], p = .033), DVT within 30 days postoperatively (OR 117.399 [15.983, 862.346], p < .001), ICU admission (OR 5.396 [1.204, 24.175], p = .028), and showed a trend toward significance as a predictor of reoperation within 30 days (OR 9.269 [0.786, 109.252], p = .077), but was not associated with an increased risk of readmission, pulmonary embolism, or epidural hematoma (Table 2).

Patients undergoing thoracic discectomy experienced longer surgeries (median 180.0 min v. 97.0 min, HR 2.362 [1.484, 2.276], logrank p < .0001, Fig. 1), longer ICU stays (median 83.0 h v. 29.0 h, HR 1.859 [1.107, 2.555], logrank p = .0172, Fig. 2), and longer hospital lengths of stay (median 5.0 days v. 1.0 days, HR 2.184 [2.261, 3.525], logrank p < .0001, Fig. 3).

Please cite this article in press as: Cloney M et al. Outcomes of thoracic discectomy: A single center retrospective series. J Clin Neurosci (2017), https://doi.org/10.1016/j.jocn.2017.10.013