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Clinical and surgical outcomes after lumbar laminectomy: An analysis of 500 patients

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Abstract

Background: The objective of this study is to determine the clinical and surgical outcomes following lumbar laminectomy.

Methods: We retrospectively reviewed medical records of neurosurgical patients who underwent first-time, bilateral, 1-3 level laminectomies for degenerative lumbar disease. Patients with discectomy, complete facetectomy, and fusion were excluded.

Results: Five hundred patients were followed for an average of 46.79 months. Following lumbar laminectomy, patients experienced statistically significant improvement in back pain, neurogenic claudication, radiculopathy, weakness, and sensory deficits. The rate of intraoperative durotomy was 10.00%; however, 1.60% experienced a postoperative cerebrospinal fluid leak. The risk of experiencing at least one postoperative complication with a lumbar laminectomy was 5.60%. Seventy-two patients (14.40%) required reoperations for progression of degenerative disease over a mean of 3.40 years. The most common symptoms prior to reoperation included back pain (54.17%), radiculopathy (47.22%), weakness (18.06%), sensory deficit (15.28%), and neurogenic claudication (19.44%). The relative risk of reoperation for patients with postoperative back pain was 6.14 times higher than those without postoperative back pain ($P < 0.001$). Of the 72 patients undergoing reoperations, 55.56% underwent decompression alone, while 44.44% underwent decompression and posterolateral fusions. When considering all-time reoperations, the lifetime risk of requiring a fusion after a lumbar laminectomy based on this study (average follow-up of 46.79 months) was 8.0%.

Conclusion: Patients experienced statistically significant improvements in back pain, neurogenic claudication, radiculopathy, motor weakness, and sensory deficit following lumbar laminectomy. Incidental durotomy rate was 10.00%. Following a first-time laminectomy, the reoperation rate was 14.4% over a mean of 3.40 years.

Key Words: Fusion, laminectomy, lumbar, outcomes, reoperation, spine

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INTRODUCTION

Lumbar laminectomy continues to be one of the most common lumbar procedures performed for spinal stenosis. According to the Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS), the annual estimate of laminectomy discharges averages around 34 discharges per 100,000 adults from 1998 to 2008.[6] Mean total hospital charges have more than doubled from $14,308 in 1998 to $35,256 in 2008. Despite the rising cost related to this procedure, most of the current literature on laminectomy focuses on combined procedures including discectomy and/or arthrodesis.[1,7] In this study, we characterized the efficacy/safety, clinical, and surgical outcomes of first-time, bilateral, 1-3 level lumbar laminectomy performed for degenerative spinal disease, excluding those undergoing concurrent discectomy and/or arthrodesis.

METHODS

We retrospectively reviewed medical records of all neurosurgical patients undergoing first-time, bilateral lumbar laminectomy for degenerative spinal disease from 1990 to 2012 at a single institution. Patients undergoing discectomy, hemilaminectomy, laminotomy, laminoplasty, complete facetectomy, and/or fusion were excluded.

All 500 patients underwent one, two, or three level lumbar laminectomy. Multiple accompanying comorbidities were also assessed (e.g. coronary artery disease, diabetes mellitus, osteoporosis, obesity, ever smoker, chronic obstructive pulmonary disease [COPD], hypertension, and depression). All had undergone complete clinical assessment by a staff neurosurgeon preoperatively. Clinical symptoms, back pain, neurogenic claudication, radiculopathy, sensory deficits, and weakness were retrospectively ascertained from clinical notes. We also evaluated those requiring subsequent lumbar surgery/reoperations to address wound dehiscence/infection, hematoma, and progression of degenerative disease. Progression of degenerative disease was defined as those who underwent reoperation for progression of disease either at the initial spinal pathology or adjacent segments. Indications for progression of degenerative disease were confirmed with radiological imaging.

Perioperative characteristics including gender, age, comorbidities, perioperative parameters, and postoperative complications were evaluated [Table 1]. Preoperative and postoperative symptoms were assessed using McNemar's exact test [Figure 1]. The time to reoperation was analyzed utilizing the Kaplan–Meier analysis. Incident rates (IRs) were expressed as a function of person-time and then converted to an annualized reoperation rate for progression of degenerative disease [Figure 2]. Measures of association were measured with regression analysis. An odds ratio was calculated with logistical regression, and a risk ratio was calculated with log-binomial regression. Statistical significance was set at $P \leq 0.05$.

RESULTS

Five hundred patients undergoing first-time, bilateral 1-3 level lumbar laminectomy for degenerative disease were followed for a mean of 46.79 months [Table 1]. Their average age at surgery was 65.64 ± 12.76 years; approximately half (56.80%) were males. At least one preoperative comorbidity was observed in 60.20% of patients (n = 301).

Table 1: Perioperative characteristics and postoperative complications in 500 patients undergoing lumbar laminectomy

Parameters	Value
Total number of cases	500
Male gender (%)	284 (56.80)
Age	65.64±12.76
Comorbidities (%)	
Coronary artery disease	60 (12.00)
Chronic obstructive pulmonary disease	19 (3.80)
Depression	20 (4.00)
Diabetes mellitus	71 (14.20)
Ever smoker	83 (16.60)
Hypertension	200 (40.00)
Obesity	20 (4.00)
Osteoporosis	16 (3.20)
Perioperative parameters	
Blood loss (interquartile range)	300, 150
Median number of levels decompressed	2
Intraoperative durotomy (%)	50 (10.00)
Length of stay (mean)	4.12±3.85
Discharge to rehabilitation (%)	47 (9.40)
Postoperative complications (%)	
Postoperative cerebrospinal fluid leak	8 (1.60)
Deep vein thrombosis	1 (0.20)
Pulmonary embolus	1 (0.20)
Surgery for hematoma evacuation	3 (0.60)
Surgical site infection	12 (2.40)
Surgery for surgical site infection	6 (1.20)
Wound dehiscence	2 (0.40)
Surgery for wound dehiscence	2 (0.40)
Reoperation (%)	72 (14.40, 100)
Adjacent segment disease	39 (54.17)
Disk herniation	23 (31.94)
New or worsening spondylolisthesis	14 (19.44)
Spinal cyst	3 (4.17)
Scoliosis	1 (1.39)

Intraoperative durotomy and postoperative cerebrospinal fluid fistulas

The rate of incidental intraoperative durotomy was 10.00% (n = 50); however, only 1.60% (n = 8 patients) experienced postoperative cerebrospinal fluid (CSF) leakage. Of the eight postoperative CSF leaks, two durotomies went undetected during the index operations. In both patients, the wound closure was accomplished with 0 polyglactin (VICRYL®, ETHICON) sutures for the fascia, 3-0 polyglactin for the skin, and staples for the skin edges. The remaining six durotomies were detected and primarily repaired during the index procedure. Of the six cases, dural repair included 4-0 nylon (NUROLON®, Ethicon) sutures (n = 2), 6-0 polypropylene (PROLENE®, Ethicon) sutures (n = 2), fibrin sealant (Evicel®, Ethicon or DuraSeal™, Covidien) (n = 3), and collagen matrix (DuraGen®, Integra) (n = 3). One patient underwent suture closure alone in a water-tight fashion, three underwent suture closure plus fibrin sealant, one patient underwent suture closure plus multilayers of fibrin sealant overlaid with collagen matrix then additional fibrin sealant, and one underwent subcutaneous fat graft fixated with collagen matrix. All six wound closures were over-sewn with 0 polyglactin sutures for the muscle layer, 2-0 (n = 1) or 3-0 (n = 5) polyglactin sutures for the fascial layers, and 3-0 nylon sutures for skin. Staples were not used to approximate the skin in any of six surgeries. Of the eight cases with postoperative CSF leakage, one patient required reoperation for repair of CSF leak; the remaining seven patients were managed with flat-bed rest and over-sewing of the wound. However, of the remaining 42 incidental durotomy cases without evidence of postoperative CSF leak, 2 patients were taken back to the operation room (OR) for pseudomeningocele repair and wound revision.

Length of stay, postoperative rehabilitation referral rate, complications, and reoperation rates

The mean length of hospital stay was 4.12 ± 3.85 days. Less than 10% required inpatient rehabilitation (n = 47). The risk of at least one postoperative complication was 5.60% (n = 28 patients ≥1 postoperative complication). Reoperations (2.0%) for nondegenerative pathologies included wound infection, dehiscence, or hematomas. Reoperations within 30 days were required in 10 patients for nondegenerative pathologies, and in 1 patient for a spinous process fracture.

Postoperative improvement in clinical symptoms

The number of patients with preoperative clinical symptoms improved in all categories following a lumbar laminectomy alone. Of 57.40% of patients presenting initially with back pain, only 25.40% had this symptom postoperatively (P < 0.001). Similar improvements (preoperative vs. postoperative) were reported for neurogenic claudication (45.40-7.00%, P < 0.001), radiculopathy (32.80% vs 13.60%, P < 0.001), weakness (18.20% vs 7.40%, P < 0.001), and sensory deficits (26.20-7.80%, P < 0.001) [Figure 1].

Reoperation rates for progression of degenerative disease

Reoperations were required in 14.40% (n = 72) of patients to address progression of degenerative disease over a mean interval of 3.40 years, yielding an annualized reoperation rate of 4.60% (IR = 0.046 person-years) [Figure 2]. The indications for reoperations included adjacent segment disease (54.17%), disc herniation (31.94%) at the index or distal level, new/worsening spondylolisthesis (19.44%), juxta-facet cysts (4.17%), and scoliosis (1.39%). In as much as progression of degenerative disease is a multifactorial condition, 55 patients were diagnosed with more than one "pathological" diagnosis. For 72 patients undergoing first-time reoperations, 55.56% (n = 40 patients) required decompression alone and 44.44% (n = 32 patients) underwent decompression and posterolateral fusion (6 of

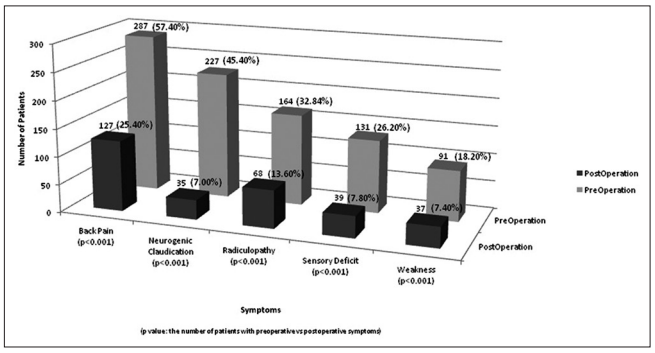

Figure 1: Preoperative symptoms versus postoperative symptoms in 500 patients who underwent first-time bilateral, lumbar laminectomy

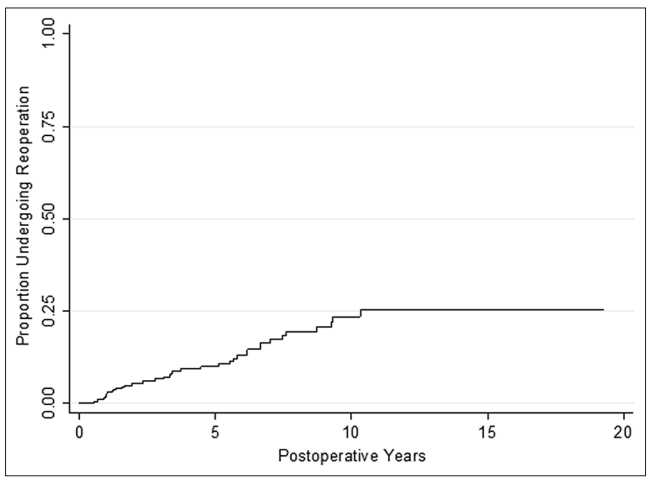

Figure 2: Kaplan–Meier curve illustrating time to reoperation for progression of degenerative disease in 500 patients who underwent first-time lumbar laminectomy. Calculated as a function of person-time, the annualized incidence rate of reoperation was 4.6% (IR=0.046 person-years)

whom included interbody devices). When considering all-time reoperations, the lifetime risk of a fusion following index lumbar laminectomy was 8.0%.

Symptoms precipitating reoperations

Of the 72 patients requiring reoperations after lumbar laminectomy, the most common recurrent symptoms included: Back pain (54.17%), radiculopathy (47.22%), neurogenic claudication (19.44%), weakness (18.06%), and sensory deficits (15.28%) [Figure 3]. Following an independent log-binomial regressions controlling for sex and age, the relative risk of reoperation among patients with postoperative back pain was 6.14 times higher than patients without postoperative back pain ($P < 0.001$). The measure of association between back pain and reoperation exceeded the relative risk ratios (RRR) in patients with postoperative radiculopathy (RRR = 5.48, $P < 0.001$), sensory deficits (2.14, $P = 0.005$), neurogenic claudication (3.13, $P < 0.001$), and motor deficits (1.76; *P*, convergence not achieved).

DISCUSSION

In a large cohort series of 500 patients who underwent first-time, bilateral, 1-3 level lumbar laminectomy, the number of patients with preoperative back pain, radiculopathy, motor weakness, sensory deficit, and neurogenic claudication statistically significantly decreased postoperatively. The rate of durotomy during a lumbar laminectomy was 10.00%. This corroborates a retrospective review of 4835 lumbar spine operations over a 10-year period, in which Jankowitz *et al.* reported an incidental durotomy rate of 11.3%.[2] Of the 500 patients in the current study, the risk of having at least one postoperative complication was 5.60%. These results are in parallel with population-based cohort studies. According to a Washington state registry of 6376 lumbar operations for degenerative conditions, at least one complication was reported in 7% of surgeries, which was statistically significantly lower than the 16% of surgeries in fusion patients ($P < 0.01$).[5]

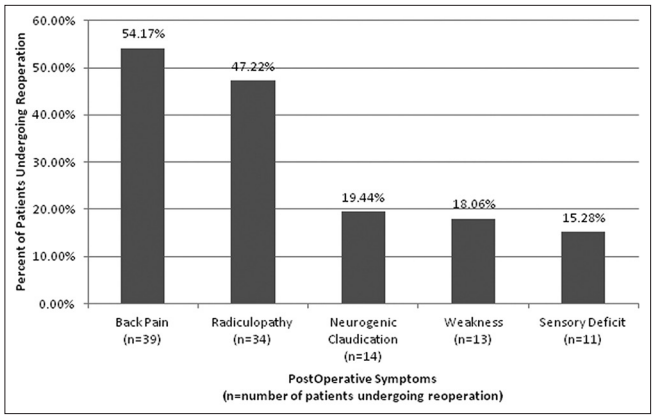

Figure 3: Postoperative symptoms following a first-time, bilateral lumbar laminectomy are illustrated for 72 patients who developed progression of degenerative disease that required reoperation

In this series of 500 patients, the total reoperation incidence for progression of degenerative disease was 14.4% over a mean of 3.40 years, yielding an annualized reoperation rate of 4.60%. In a retrospective review of 88 patients undergoing lumbar laminectomy, Katz *et al.* reported a total reoperation incidence of 17% and 1-year reoperation incidence of 6%.[4] In the present study, the lifetime risk of fusion following first-time laminectomy was 8%. Patients with postoperative back pain had a relative risk of reoperation over six times higher than those without postoperative back pain. In a prospective study of 194 patients who underwent lumbar laminectomy for degenerative spinal stenosis, the predominance of back pain as opposed to leg pain predicted lower patient satisfaction.[3] Nevertheless, clinically significant improvements in neurological symptoms, including neurogenic claudication, weakness, and sensory disturbances were still reported following lumbar decompression.

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