



Clinical Study

Perioperative and postoperative complications of single-level minimally invasive transforaminal lumbar interbody fusion in elderly adults

Peter Lee*, Richard G. Fessler

Department of Neurological Surgery, Northwestern University Feinberg School of Medicine, 676 North St Clair Street, Suite 2210, Chicago, IL 60611, USA

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ABSTRACT

As the population ages, more elderly patients will develop painful degenerative lumbar pathology requiring lumbar fusion for treatment. Unfortunately, traditional techniques for lumbar fusion have been associated with increased morbidity and mortality in elderly patients. Minimally invasive transforaminal lumbar interbody fusion (TLIF) has been associated with fewer complications; however, little specific to the elderly population has been published. Thus, we performed a retrospective analysis on 84 consecutive patients (<65 years, young – 45 patients; ≥ 65 years, elderly – 39 patients) who underwent single-level, minimally invasive TLIF between October 2007 and December 2010. Hospital records, including operative notes, progress notes, and discharge summaries, were reviewed for patient demographics, procedures, disposition, and perioperative and postoperative complications. There was no significant difference between the young and elderly patients with respect to the total number of major, minor, or major and minor complications. Likewise, there was no significant difference between the two groups with respect to the number of patients experiencing one or more major, minor, or major and minor complications. The overall rate of experiencing at least one perioperative or postoperative complication was 16.33% for young patients and 20.00% in the elderly cohort ($p = 0.7748$). Thus, elderly patients with single-level degenerative lumbar pathology requiring fusion are not at increased risk of perioperative and postoperative complications compared to younger patients when undergoing single-level, minimally invasive TLIF.

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1. Introduction

As the general population ages due to advances in medicine, the number of elderly patients presenting with painful degenerative pathology of the lumbar spine requiring lumbar fusion for treatment will increase.¹ Traditional techniques for achieving lumbar fusion include the posterior lumbar interbody fusion (PLIF) and, more recently, the transforaminal lumbar interbody fusion (TLIF). Multiple studies have demonstrated a considerable risk of morbidity and mortality following lumbar fusion in elderly patients using these traditional approaches.^{2–4} Carreon et al. observed an overall complication rate of 80% in their patients 65 years of age and older undergoing posterior lumbar fusion.² In their series of 18,122 patients, those 65 years of age and older were more than twice as likely to experience complications compared to younger patients during their hospitalization.³ Additionally, 12 of the 13 perioperative deaths in their series were in patients 65 years and older – mostly due to cardiovascular complications.³

Recent technological advances in spinal instrumentation have culminated in the development of the minimally invasive TLIF procedure.^{5–7} By minimizing approach-related morbidity, several investigators have demonstrated that minimally invasive TLIF results in less intraoperative blood loss, less postoperative pain, decreased postoperative narcotic usage, earlier ambulation, and decreased length of hospitalization compared to traditional fusion techniques.^{5,8,9}

Although perioperative and postoperative complications and surgical outcomes associated with minimally invasive TLIF have been well described in the literature, little is published that is specific to elderly patients – who stand to gain the most from this technique.^{10–12} The present study was undertaken to examine the rate of perioperative and postoperative complications in patients 65 years and older undergoing single-level, minimally invasive TLIF and to see if the incidence of complications differs from that of a younger cohort.

2. Materials and methods

A retrospective analysis was performed on 84 consecutive adult patients who underwent single-level TLIF at Northwestern

* Corresponding author. Tel.: +1 312 695 6285; fax: +1 312 695 0225.

E-mail address: peter-lee@fsm.northwestern.edu (P. Lee).

Memorial Hospital, Chicago, IL, USA. Patients who underwent surgery for degenerative pathology were considered eligible for the study regardless of whether or not they had undergone prior surgery at the index level. Exclusion criteria included patients undergoing a multi-level TLIF procedure, extension of fusion, revision of fusion, or surgery for non-degenerative conditions (e.g. infection, trauma, or tumor). The TLIF procedures were performed using a tubular retractor for the inferior facetectomy, discectomy, and interbody cage placement. Interbody arthrodesis was augmented with locally harvested autograft and recombinant human bone morphogenic protein type 2 (rhBMP-2). This was followed by posterior percutaneous pedicle screw fixation and instrumentation bilaterally. All procedures were performed by the senior author (R.G.F.) assisted by spine fellows between 2007 and 2010. Hospital records, including operative notes, progress notes, and discharge summaries, were reviewed for patient demographics, procedures, disposition, and perioperative and postoperative complications.

Complications were defined as any event where the patient required a specific intervention or treatment and were categorized as being either major or minor using the classification system described by Carreon et al. Complications which adversely affected the recovery of the patient were major. Complications which did not alter the patient's recovery were considered minor. The perioperative period was defined as seven days after surgery and the postoperative period was defined as 30 days after surgery.

An *a priori* power analysis suggested that minimum group sizes of 27 would have 80% power to detect a difference between the number of complications in the elderly and young cohorts, assuming a significance level of 0.05 and a large effect size of 0.8. Data were analyzed using JMP 8.0.2 software (Statistical Analysis System, SAS Institute, Cary, NC, USA). The difference between two groups was tested using the Wilcoxon rank sum test for continuous variables and with Fisher's exact test for nominal variables. A $p < 0.05$ was considered significant.

3. Results

A total of 84 consecutive patients who underwent a single-level TLIF procedure between October 2007 and December 2010 met the study inclusion criteria. Of the 84 patients, 49 patients were less than 65 years and 35 patients were 65 years and older. There were no significant differences between the two groups regarding patient characteristics except for the level of fusion, length of hospitalization, and disposition (Table 1). Among elderly patients, there was a preponderance of patients undergoing minimally invasive TLIF of L4–L5 ($p = 0.0020$). Elderly patients also had longer lengths of hospitalization (3.89 days *versus* 2.49 days, $p = 0.0071$) and were discharged to subacute nursing facilities or acute inpatient rehabilitation centers more frequently (17.14% *versus* 0%, $p = 0.0040$) than younger patients.

Among major complications, there were no instances of wound infections, malpositioned hardware, neurologic deficits, myocardial infarctions, cerebrovascular accidents, complex pneumonia, or renal failure (Table 2). One elderly patient with a significant cardiac history experienced two major complications when he developed respiratory distress on postoperative day (POD) 0 in the recovery room that required intubation secondary to an episode of congestive heart failure exacerbation. He was subsequently extubated on POD 1 and treated with beta-blockers and diuresis under the guidance of the cardiology service. The remaining major complication was in an elderly, morbidly obese patient with a history of multiple prior abdominal surgeries and a ventral hernia that became incarcerated leading to small bowel strangulation and perforation after surgery. The patient was brought to the operating room for an exploratory laparotomy, lysis of adhesions, and small bowel resection on POD 4 after L4–L5 TLIF. Three days later, the patient was brought back

Table 1

Patients who underwent single-level minimally invasive transforaminal lumbar interbody fusion

	Age < 65 years (young)	Age ≥ 65 years (elderly)	P level
No. patients (n)	49	35	
Age (years, SD)	50.73 (11.14)	70.49 (4.42)	<0.0001
Gender			0.3762
Male	27 (55.10)	15 (42.86)	
Female	22 (44.90)	20 (57.14)	
Mean height (inch, SD) ^a	68.15 (4.39)	66.60 (3.26)	0.1505
Mean weight (pound, SD) ^b	183.70 (40.42)	181.16 (49.18)	0.5019
Body Mass Index (n,%)			0.4980
Underweight	–	–	
Healthy	16 (32.65)	12 (34.29)	
Overweight	20 (40.82)	12 (34.29)	
Obese	13 (26.53)	9 (25.71)	
Morbidly obese	–	2 (5.71)	
Prior surgery (%)			0.2089
No	39 (79.59)	23 (65.71)	
Yes	10 (20.41)	12 (34.29)	
Diagnosis (n,%)			0.0682
Degenerative disc disease	23 (46.94)	9 (25.71)	
Spondylolisthesis	26 (53.06)	26 (74.29)	
Side of approach (n,%)			0.8251
Left	23 (46.94)	18 (51.43)	
Right	26 (53.06)	17 (48.57)	
Level of fusion (n,%)			0.0020
L3–L4	2 (4.08)	3 (8.57)	
L4–L5	25 (51.02)	28 (80.00)	
L5–S1	22 (44.90)	4 (11.43)	
Surgical time (min, SD)	172.12 (35.97)	180.57 (37.07)	0.2722
Estimated blood loss (mL, SD)	93.37 (102.16)	100 (61.24)	0.1373
Length of stay (days, SD)	2.49 (0.89)	3.89 (4.87)	0.0071
Disposition (n,%)			0.0040
Home	49 (100)	29 (82.86)	
Subacute nursing facility	–	4 (11.43)	
Acute inpatient rehabilitation	–	2 (5.71)	

Min = minutes, SD = standard deviation.

^a One inch = 2.54 cm.

^b 2.2 pounds = 1 kg.

to the operating room for an abdominal washout and small bowel reanastomosis. Following the reanastomosis, the patient was brought back to the operating room the next day for an abdominal washout and Vicryl mesh placement for open abdomen. A wound vacuum assisted closure device was placed and the patient was eventually discharged to a skilled nursing facility on POD 31 with plans to return for eventual wound closure and possible skin grafts. Because of the prolonged hospitalization, the patient also developed a urinary tract infection (minor complication) which was treated with antibiotics.

The most common minor complication observed was urinary retention in five patients, two patients in the young cohort and three patients in the elderly cohort (Table 2). Minor intraoperative complications included durotomy (treated with the application of a synthetic absorbable hydrogel sealant) and technical difficulties with neuromonitoring. There was one instance where somatosensory evoked potentials were diminished/lost shortly after the start of a TLIF. After troubleshooting the neuromonitoring leads and repositioning the patient's arms, a wake up test was performed where the patient was able to freely squeeze with his hands and move his

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