

The Safety and Efficacy of Posterior Lumbar Interbody Fusions in the Outpatient Setting

Type: Case Report

Received: October 24, 2023

Published: November 27, 2023

Citation:

Taylor J Manes., et al. "The Safety and Efficacy of Posterior Lumbar Interbody Fusions in the Outpatient Setting". PriMera Scientific Surgical Research and Practice 2.6 (2023): 30-36.

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Abstract

Background: Outpatient surgical procedures have shown reduced costs, improved patient outcomes, and decreased postoperative complications. Interest in moving orthopedic and neurosurgical spine procedures to the outpatient setting has grown in recent years because of these factors. Studies investigating open posterior lumbar interbody fusions (PLIF) in the outpatient setting are sparse.

Methods: Patients who underwent an open PLIF with pedicle screw and rod construct from 2014 to 2018 were retrospectively reviewed. Outpatient procedures were defined by patient discharge being on the same day of procedure, without admittance to an inpatient ward. Pertinent demographic, clinical, radiographic, and surgical data were collected and analyzed.

Results: The current study included 36 outpatient PLIF cases with 94.4% of the study cohort undergoing a single level PLIF. The average Oswestry Disability Index Score improved by 20.4 points from preoperative measurements ($p = 0.0002$) and the Visual Analog Scale Score improved by 27.2 points ($p = 0.0001$). Postoperative fusion rate was 94.4%. One intraoperative complication occurred (2.78%), and four post-operative complications occurred (11.11%). There were no subsequent admissions throughout the postoperative follow up period; however, two of the 36 patients (5.56%) did require reoperation, both in an outpatient setting.

Conclusion: This study demonstrates that open posterior lumbar interbody fusions performed in an outpatient setting can be performed safely and effectively, with a significant reduction in VAS and ODI pain scores.

Keywords: Posterior lumbar interbody fusion; Outpatient lumbar fusion; Same-day discharge; Spinal fusion; Open surgery

Introduction

Throughout the last two decades, the rates of spine surgeries have seen consistent growth in both the inpatient and outpatient setting [1, 2]. Specifically, posterior lumbar interbody fusions (PLIF) have become more common as new instrumentation has developed and procedural techniques have improved [3]. The number of spinal fusions has increased 62.3% from 2004 to 2015, representing a 177% increase in spending [1]. In an effort to reduce the overall cost of spinal surgery, surgeons are choosing to perform procedures in a setting where it can be done both safely and effectively. Outpatient procedures have shown several benefits, including reduction of associated healthcare expenses, decreased exposure to infections, and reduced risk of medical errors [4, 5].

Due to these benefits, the number of outpatient PLIFs performed has continued to rise; however, data on outpatient open PLIF remains sparse and without consensus. Outpatient open posterolateral single level spinal fusions has demonstrated a significant decrease in Visual Analog Scale and Oswestry Disability Index scores, as well as a high fusion rate with a low incidence of complications [6]. Similarly, a recent study demonstrated comparable complication rates between patients undergoing inpatient and outpatient posterior lumbar fusions [7]. In the cervical spine, Boddapati et al. state that patient selection is the most important factor when determining whether outpatient surgery is offered for three and four-level anterior cervical discectomies and fusion procedures [8].

The safety and efficacy of outpatient open PLIFs has not been thoroughly investigated. In the past, this has largely been due to the limitation of outpatient surgery sample size. This study is a retrospective report on the clinical and radiographic outcomes in 36 patients who underwent outpatient open PLIFs in a single surgery center by two orthopedic spine surgeons.

Methods

After formal institutional board review approval was obtained, a retrospective review of all patients undergoing open outpatient posterior lateral interbody fusions (PLIFs) from January 1, 2014 to December 31, 2018 at a single institution was conducted. Current Procedural Terminology (CPT) codes were used to survey all patients operated on within the respective time window to delineate those having undergone PLIF in an outpatient setting. Inclusion criteria consisted of all patients, aged 18-85, who have undergone either a one- or two-level outpatient open PLIF between the dates January 1, 2014 to December 31, 2018. Each patient underwent decompression with posterior interbody insertion and pedicle screw and rod constructs with a posterolateral fusion. Exclusion criteria included patients with a spinal tumor, previous spinal infection, and greater than a two-level open PLIF. All surgeries were performed by two fellowship trained orthopedic spine surgeons at a single ambulatory surgery center. The electronic medical record was used to obtain demographic data, surgical data, and postoperative outcome measurements. Oswestry Disability Index (ODI), Visual Analog Scale (VAS), and plain radiographs were obtained at each postoperative visit. Readmission was considered for the first 90 days postoperatively. No outside funding was received for this study.

Statistical Analysis

Statistical analysis was performed, with continuous variable reported as mean values and standard deviations, with categorical variables reported as percentage. Microsoft Excel (Redmond, WA) was used for data computation.

Results

A total of 881 patients underwent PLIF between January 1, 2014, and December 31, 2018. Of this total, 845 patients underwent inpatient admission after their operative spinal fusion. This left a total 36 patients who met inclusion criteria and underwent a one- or two-level outpatient PLIF. Demographic data for this patient cohort is shown in Table 1. The average age was 48 years and 58% of patients were male.

Variable	Result
Age (years)	48.03 ± 9.3 (32-68)
30-42	10 (27.8%)
43-55	17 (47.2%)
56-68	9 (25.0%)
Sex (male)	21 (58.3%)
BMI (kg/m ²)	30.5 ± 5.4
17-25	6 (16.7%)
25-30	8 (22.2%)
30-35	14 (38.9%)
> 35	8 (22.2%)
ASA Score	2.02 ± 0.30 (1-3)
1	1 (2.8%)
2	32 (88.9%)
3	3 (8.3%)
Tobacco Use (Yes)	12 (33.3%)
Hypertension (Yes)	9 (25.0%)

BMI: Body Mass Index.

ASA: American Society of Anesthesiologists Classification.

Table 1: Patient Demographics and Injury Characteristics.

Operative variables are shown in Table 2. Out of the 36 patients, 94.44% (34/36) had a single level PLIF and 5.56% (2/36) had a two level PLIF performed. The most common levels instrumented were L5-S1 (61.11%), L4-L5 (33.33%), and L4-S1 (5.56%). The mean length of stay was 6.06 ± 1.2 hours. Only 5.56% (2/36) of the population had a drain placed intraoperatively, which was removed by the family on post operative day three. No patients in the study suffered from postoperative urinary retention, while 3 (8.33%) patients suffered from postoperative nausea and vomiting in the early postoperative period.

Variable	Result
Levels Fused	
L4-L5	12 (33.3%)
L5-S1	22 (61.1%)
L4-S1	2 (5.6%)
Number of Levels Fused	1.06 ± 0.23 (1-2)
One Level	34 (94.4%)
Two Level	2 (5.6%)
Length of Stay (Hours)	6.06 ± 1.2
4-6	21 (58.3%)
6-8	12 (36.1%)
8-10	2 (5.6%)
Surgical Time (Minutes)	63.9 ± 12.5
40-59	17 (47.2%)
60-79	14 (38.9%)
80-100	5 (13.9%)

EBL (mL)	181.9 ± 240.0
0-199	26 (72.2%)
200-400	9 (25.0%)
> 401	1 (2.78%)

EBL: Estimated Blood Loss.

Table 2: Surgical Data.

One intraoperative complication occurred (2.78%) within this study population, which was an incidental durotomy. The patient was an obese 49-year-old male who underwent a previous laminectomy at the index level. The patient convalesced at the outpatient center and was subsequently discharged to home in stable condition without any subsequent complications.

Post operative outcome measurements are presented in Table 3. Average follow up was 12.2 months. There were no readmissions in the postoperative period. There were no postoperative infections. The conversion rate from outpatient to inpatient was 0%.

<i>Variable</i>	<i>Result</i>
Follow up (Months)	12.2 ± 6.2
Fusion (Yes)	34 (94.4%)
Conversion to Inpatient	0 (0%)
Complications	4 (11.1%)
Reoperation	2 (5.56%)
Infection	0 (0%)
ODI Score	
Preoperative	46.6 ± 3.1
Postoperative	26.3 ± 3.8
VAS Pain Score	
Preoperative	62.7 ± 4.6
Postoperative	35.5 ± 5.4

ODI Pain Score: Oswestry Disability Index Score.

VAS Pain Score: Visual Analog Pain Back Pain Score.

Table 3: Postoperative Data.

The mean ODI preoperative pain score of 46.6 ± 3.1 improved significantly to a mean score of 26.3 ± 3.8 ($p = 0.0002$) at final follow up. The mean VAS lower back pain score of 62.7 ± 4.6 improved to a score of 35.5 ± 5.4 ($p = 0.0001$) at final follow up. Overall fusion rate was 94.4% (34/36), with a 5.56% (2/36) rate of nonunion at one year follow up. Eight of the 36 patients did not have follow up at one year due to being discharged early. They were discharged prior to their one year follow up because they were clinically doing well, and final radiographs showed fusion progressing uneventfully.

There were four (11.1%) postoperative complications in the study population. One was hardware failure in the setting of a broken pedicle screw. The patient was asymptomatic, and this did not require intervention as the patient went onto successful union of the fusion mass. A second patient had uncontrollable pain five days postoperatively and presented to the emergency department. She was neurologically intact and discharged from the emergency department with an increase in oral pain medication. Two patients who underwent one level PLIF had symptomatic pseudoarthrosis of their fusion based on advanced postoperative imaging and underwent revision surgery at the index level. Both went onto successful fusion. None of the patients with postoperative complications had a previous history of smoking. Only 5.56% (2/36) required a reoperation, which were the two previously mentioned patients with pseudoarthrosis.

Discussion

The rise in rates of elective lumbar fusion surgeries in the previous 20 years is likely multifactorial in cause and has had a significant economic impact. With 122,679 cases performed in 2004 and 199,140 performed in 2015, lumbar fusion surgery aggregate costs have increased 177% [1]. During that time, surgeons have increasingly used interbody procedures to increase anterior column fusion mass and promote indirect decompression [9]. Accompanying these changes, fusion rates and patient outcomes have improved [9]. Even with the advancements of new techniques, the traditional posterior approach to fusion is still the technique most often used by surgeons. Many spine surgeons are well trained and extensively experienced at this procedure. The single midline incision allows for excellent visualization of the nerve roots, with 360-degree fusion and anterior column support [10].

Despite the recent improvements in the field of lumbar surgery, certain challenges still remain. One such challenge is the cost of inpatient fusion surgeries. A study by Martin et al. reported average costs of over \$50,000 for inpatient lumbar fusion procedures [1]. A review article by Mikhail et al. found that outpatient short segment lumbar fusion can have significant cost savings up to 65-70%, mainly by reducing admissions [11]. These findings were supported by a retrospective cohort study of 100 patients comparing the postoperative course for both inpatient and outpatient spinal fusions, with a significantly reduced economic burden for those in the outpatient group [12]. Of note, selection bias is likely present in patients who receive outpatient fusions. A meta-analysis of 370,195 patients with outpatient spinal surgeries found that while they did have better short-term outcomes and reduced costs, a significant selection bias was present due to confounding variables such as younger patient age and decreased comorbidities [2].

In our report of patients undergoing outpatient open PLIF, solid fusion was demonstrated both clinically and radiologically in 94.44% of patients. We report a low complication and reoperation rate as well as an improvement in clinical outcome scores. Patients reported overall positive outcomes with a statically significant decrease in ODI scores ($p = 0.0001$) and VAS scores ($p = 0.0002$).

A study by Asher et al. examined the threshold for the minimum clinically important difference (MCID) in ODI scores in lumbar spine surgery patients at one year of follow-up [13]. The MCID in ODI scores ranged from 3.3 to 26.6, depending on the metric used and they determined the MCID to be a change of 14.3 points in the ODI score [13]. Our study reports a decrease in mean ODI scores of 20.4 points, which points to a clinically important difference. A meta-analysis of 37 studies reported the MCID in pain scores such as VAS and the numeric rating scale [14]. The MCID for VAS ranged from 8 to 40 in various studies, with a median of 17 [14]. The 27.2 point decrease in VAS reported in our study cohort further illustrates that the improved postoperative outcomes are of clinical significance.

Patient outcomes measured by complications appear to point to the safety of outpatient open PLIFs in this study. A single intraoperative complication was noted, which was an incidental durotomy. This was a revision surgery, in an obese male, with intraoperative findings of fibrosis. The patient recovered without further complication. Two patients required reoperation one year after surgery due to pseudoarthrosis, neither of which had any previous history of smoking. The rate of observed pseudoarthrosis in this study was 5.56%, which is similar to previously reported studies [15, 16]. Chin et al. reported outcomes of 16 patients receiving outpatient PLIF and TLIF surgeries with a fusion rate of 87.5% [6]. Only one postoperative complication was reported in a female patient presenting with aseptic/low-grade discitis after failure to take postoperative oral antibiotics [6]. In a report of 74 PLIF and TLIF surgeries, Asil et al. reported dural injury in 12 patients, which all recovered fully without additional complication [17].

The mean operation time reported in our study was 63.9 ± 12.5 minutes, which is comparatively short for this procedure in review of recent literature. Surgical time was recorded as time from incision to time of surgical closure. A study of 40 patients from Ntoukas and Muller showed a mean surgical time of 152 minutes in an open PLIF group compared to 275 minutes in a MIS group [18]. A study by Cheng et al. found a reduced surgical time to be linked to a reduced risk of surgical site infection [19]. The low complication rate observed in this study may be partially explained by the reduced operative time.

One limitation of this study is short follow up of one year; however, each patient was doing well at final follow up. An additional limitation is the lack of a comparison group to an inpatient cohort. Advantages of this study includes a larger patient population than similar reported studies and a homogenous group of patients, all of which underwent open PLIF by one of two surgeons. Conclusions

regarding the safety and efficacy of this procedure would be bolstered by a larger, prospective randomized control trial to assess patient outcomes with minimal bias. Further investigations could detail this procedure in juxtaposition to an inpatient control group, as well as assess the safety and efficacy of outpatient interbody fusions through direct lateral or anterior-to-psoas approaches.

Conclusion

This retrospective review detailed the clinical outcomes of one and two-level posterior lumbar interbody fusions performed in an outpatient setting. The clinical outcome data from this patient cohort showed no readmissions, as well as low complication and reoperation rates (11.11% and 5.56%, respectively). In addition to high fusion rates (94.44%), this sample showed a significant reduction in both ODI ($p = 0.0002$) and VAS ($p = 0.0001$) clinical outcome scores. Ultimately, this investigation supports the notion that posterior lumbar interbody fusions are both safe and effective when completed in an outpatient setting.

References

1. Martin BI, et al. "Trends in Lumbar Fusion Procedure Rates and Associated Hospital Costs for Degenerative Spinal Diseases in the United States, 2004 to 2015". *Spine (Phila Pa 1976)* 44.5 (2019): 369-376.
2. Mundell BF, et al. "Does patient selection account for the perceived cost savings in outpatient spine surgery? A meta-analysis of current evidence and analysis from an administrative database". *J Neurosurg Spine* 29.6 (2018): 687-695.
3. de Kunder SL, et al. "Transforaminal lumbar interbody fusion (TLIF) versus posterior lumbar interbody fusion (PLIF) in lumbar spondylolisthesis: a systematic review and meta-analysis". *Spine J* 17.11 (2017): 1712-1721.
4. Cuéllar JM, Lanman TH and Rasouli A. "The Safety of Single and Multilevel Cervical Total Disc Replacement in Ambulatory Surgery Centers". *Spine (Phila Pa 1976)* 45.8 (2020): 512-521.
5. Snowden R, Fischer D and Kraemer P. "Early outcomes and safety of outpatient (surgery center) vs inpatient based L5-S1 Anterior Lumbar Interbody Fusion". *J Clin Neurosci* 73 (2020): 183-186.
6. Chin KR, Coombs AV and Seale JA. "Feasibility and patient-reported outcomes after outpatient single-level instrumented posterior lumbar interbody fusion in a surgery center: preliminary results in 16 patients". *Spine* 40.1 (2015): E36-42.
7. Arshi A, et al. "Outpatient Posterior Lumbar Fusion: A Population-Based Analysis of Trends and Complication Rates". *Spine* 43.22 (2018): 1559-1565.
8. Boddapati V, et al. "Are outpatient three- and four-level anterior cervical discectomies and fusion safe?". *Spine J* 21.2 (2021): 231-238.
9. Makanji H, et al. "Critical analysis of trends in lumbar fusion for degenerative disorders revisited: influence of technique on fusion rate and clinical outcomes". *Eur Spine J* 27.8 (2018): 1868-1876.
10. Diedrich O, et al. "Die dorsale lumbale interkorporelle Fusion mit Cages (PLIF) und transpedikulärer Stabilisierung [The posterior lumbar interbody fusion with cages (PLIF) and transpedicular stabilization]". *Zentralbl Neurochir* 62.3 (2001): 106-13.
11. Mikhail CM, et al. "Recoup From Home? Comparison of Relative Cost Savings for ACDF, Lumbar Discectomy, and Short Segment Fusion Performed in the Inpatient Versus Outpatient Setting". *Global Spine J* 11.1 (2021): 56S-65S.
12. Schlesinger S, et al. "Thirty-Day Outcomes from Standalone Minimally Invasive Surgery-Transforaminal Lumbar Interbody Fusion Patients in an Ambulatory Surgery Center vs. Hospital Setting". *Cureus* 12.9 (2020): e10197.
13. Asher AL, et al. "Defining the minimum clinically important difference for grade I degenerative lumbar spondylolisthesis: insights from the Quality Outcomes Database". *Neurosurg Focus* 44.1 (2018): E2. *Neurosurg Focus* 44.4 (2018): E15.
14. Olsen MF, et al. "Pain relief that matters to patients: systematic review of empirical studies assessing the minimum clinically important difference in acute pain". *BMC Med* 15.1 (2017): 35.
15. DiPaola CP and Molinari RW. "Posterior lumbar interbody fusion". *J Am Acad Orthop Surg* 16.3 (2008): 130-9.
16. Yun DJ, et al. "Salvage Anterior Lumbar Interbody Fusion for Pseudoarthrosis After Posterior or Transforaminal Lumbar Interbody Fusion: A Review of 10 Patients". *World Neurosurg* 111 (2018): e746-e755.
17. Asil K and Yaldiz C. "Retrospective Comparison of Radiological and Clinical Outcomes of PLIF and TLIF Techniques in Patients Who Underwent Lumbar Spinal Posterior Stabilization". *Medicine (Baltimore)* 95.17 (2016): e3235.

18. Ntoukas V and Müller A. "Minimally invasive approach versus traditional open approach for one level posterior lumbar interbody fusion". *Minim Invasive Neurosurg* 53.1 (2010): 21-4.
19. Cheng H., et al. "Prolonged Operative Duration Increases Risk of Surgical Site Infections: A Systematic Review". *Surg Infect (Larchmt)* 18.6 (2017): 722-735.