A Comparative Analysis Between ALIF and TLIF for the Indication of L5/S1 Isthmic Spondylolisthesis.

Erik Y Tye BA; Andrea Alonso; Joseph E Tanenbaum BA; Roy Xiao BA; Thomas E. Mroz MD; Michael P. Steinmetz MD; Jason Savage MD

Cleveland Clinic

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Introduction

Transforaminal lumbar interbody fusion (TLIF) with posterolateral fusion (PLF) or anterior lumbar interbody fusion (ALIF) with percutaneous pedicle screw fixation (PPSF) offer significantly higher radiographic fusion rates than other fusion techniques for L5-S1 isthmic spondylolisthesis (IS). Few studies have compared both techniques regarding clinical, radiographic, and financial outcomes for the treatment of L5-S1 IS. This study aims to provide evidence to guide spine surgeons towards the preferred surgical approach.

Methods

This retrospective study reviewed patients who underwent either TLIF with PLF or ALIF with PPSF for L5-S1 IS between 2009-2014. Quality of life outcome scores, radiographic data, and financial data were collected with a minimum of 1-year follow up. Continuous variables were compared using either independent t-tests assuming unequal variance or Whitney-Mann U tests

Table 1: Patient Demographics

Demographic	TLIF	ALIFPS	*p*-value
Subjects, No.	25	41	
Male	14 (56%)	28 (68%)	0.3†
Age (Years)	52.4±11.1	53.1±10.8	0.9†
BMI	28.9±4.5	29.6±5.4	0.7†
Current Smoker	9 (36%)	14 (34%)	0.8†
Duration of Symptoms (Months)*	19.8 (14.5, 27.8)	17.3 (12.5, 28.3)	0.5‡

Values are presented as mean ± standard deviation or number (%).
No., Number; BMI: Body Mass Index; ALIFPS: Anterior Lumbar Interbody Fusion with Percutaneous Pedicle Screw Fixation; TLIF: Transforaminal Lumbar Interbody Fusion; IQR: Interquartile Range
*Data presented as Median with IQR
†t-tests for continuous variables and chi-square tests for categorical variables comparing ALIFPS vs. TLIF
‡Whitney-Mann U tests used for inter-cohort comparisons for continuous variables that were not normally distributed.

Results

66 patients met inclusion criteria. In the ALIF cohort, Pain Disability Questionnairescores improved from 69 [47,82] to 26 [18.2,79.7],p=0.02. In the TLIF cohort, PDQ scores improved from 73 [46,85] to 48.5 [23, 67.5], p = 0.01. Both groups also showed a significant improvement in EuroQol-5 Dimension Health State scores at 1 year, but the ALIF group showed a significantly greater improvement in EQ-5D scores at 1 year (0.1 [0,0.2] vs 0.2 [0.1,0.4],p=0.02). Furthermore, only the ALIF cohort showed a significant improvement in segmental lordosis. The ALIF cohort showed a significantly greater improvement in disc height compared to TLIF(3.5 [2,5.5] v. 6.7 [4.1,10], p=0.01) No significant differences were found with regards to costs of both procedures.

Table 3: Quality of Life Outcomes

Variable	TLIF	*p*-value†	ALIFPS	*p*-value†	*p*-value‡
PDQ – Total					
Preoperative Median (IQR)	69 (47, 82)	**p=0.02**	73 (46, 85)	**p=0.01**	0.9
Postoperative Median (IQR)	26 (18.2, 79.7)		48.5 (23, 67.5)		0.6
ΔPDQ Median (IQR)	-16 (-52, 6)		-22 (-52, -4.8)		0.8
PHQ-9					
Preoperative Median (IQR)	6 (3, 7.5)	p=0.9	6 (3.5, 12.5)	p=0.2	0.4
Postoperative Median (IQR)	6 (2, 7.5)		3 (2, 7)		0.4
ΔPHQ-9 Median (IQR)	-1 (-3, 1)		-2(-8, 0)		0.1
QALY					
Preoperative Median (IQR)	0.7 (0.5, 0.8)	**p=0.04**	0.5 (0.3,0.7)	**p=0.01**	0.06
Postoperative Median (IQR)	0.8 (0.7, 0.8)		0.8 (0.7,0.8)		0.1
ΔQALY Median (IQR)	0.1 (0, 0.2)		0.2 (0.1,0.4)		**0.02**
MCID					
PDQ	13 (30%)		8 (33%)		0.8*
PHQ-9	7 (17%)		4 (17%)		1*
QALY	3 (12%)		3 (12%)		0.5*

PDQ: Pain Disability Questionnaire; PHQ-9: Patient Health Questionnaire; QALY: Quality-Adjusted Life-Year; MCID: Minimally Clinical Important Difference; IQR: Interquartile Range.
Values are presented as either median (IQR) or mean and number (%) for non-parametric and parametric variables, respectively. Bolded indicates significance
*Chi-square tests for categorical variables comparing ALIFPS vs. TLIF
†Whitney-Mann U tests used for intra-cohort comparisons for continuous variables that were not normally distributed.
‡Whitney-Mann U tests used for inter-cohort comparisons for continuous variables that were not normally distributed.

Conclusions

Our findings are in support of the ALIF technique achieving better clinical outcomes compared to TLIF for the treatment of IS. We believe the superior radiographic outcomes achieved through ALIF, namely a greater restoration of segmental lordosis and disc height, may have contributed to the greater clinical outcomes presented in the current study.

Learning Objectives

1. To understand the common surgical procedures utilized for the treatment of L5-S1 isthmic spondylolisthesis (IS).
2. To recognize the unique advantages/disadvantages of both techniques.
3. To compare the clinical, radiographic, and financial outcomes in patients with L5-S1 IS undergoing either ALIF with PPSF or TLIF with PLF.

Table 2: Surgical Characteristics and Outcomes

	TLIF	ALIFPS	*p*-value
Complications			
Pseudoarthrosis	1 (7%)	1 (3%)	0.6†
Durotomy	0 (0%)	0 (0%)	
Infection	0 (0%)	0 (0%)	
Slip Grade			
Grade I	*8 (32%)*	*19 (46%)*	*0.3*
Grade II	*17 (64%)*	*22 (54%)*	*0.3*
Reoperation Rate	5 (17%)	1 (7%)	0.5†
Procedure Time (min); Median (IQR)	252 (209.2, 279.2)	241 (183.7, 287)	0.9‡
Blood Loss (mL); Median (IQR)	250 (187.5,425)	200 (100,300)	**0.04‡**
Follow-Up (months); Median (IQR)	13 (7,24.3)	12.5 (8.3,21.6)	0.8‡
Length of Hospital Stay (days); Median (IQR)	3.7 (2.7,4.1)	2.8 (2.7,3.6)	0.05‡

Values are presented as mean ± standard deviation or number (%).
Min: minutes; mL: milliliters; ALIFPS: Anterior Lumbar Interbody Fusion with Percutaneous Pedicle Screw Fixation; TLIF: Transforaminal Lumbar Interbody Fusion; IQR: Interquartile Range
Bolded indicates significance
†Chi-square tests for categorical variables comparing ALIFPS vs. TLIF
‡Whitney-Mann U tests used for inter-cohort comparisons for continuous variables that were not normally distributed.

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