

# Cost-Analysis of Single-Position versus Conventional Dual Positioning for Lumbar Interbody Fusions

Jacob R. Ball<sup>1</sup>, Andy Ton<sup>1</sup>, Benjamin Hopkins<sup>1</sup>, Fergui Hernandez<sup>1</sup>, Nicole Hang<sup>1</sup>, Edward Shontz<sup>1</sup>, Zabi Bajouri<sup>1</sup>, Emily S. Mills<sup>1</sup>, Jeffrey C. Wang<sup>1</sup>, Ram Alluri<sup>1</sup>, Raymond J Hah<sup>1</sup>

<sup>1</sup>Department of Orthopaedic Surgery, University of Southern California Keck School of Medicine, Los Angeles, CA US

[jacob.ball@med.usc.edu](mailto:jacob.ball@med.usc.edu)

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**Introduction:** Single-position (SP) techniques for lumbar fusion have gained considerable interest in attribution to their improved operative efficiency and reduced complication risks relative to conventional dual-positioning (DP), wherein patients are repositioned from either supine or lateral decubitus positioning to prone for subsequent pedicle screw fixation. The SP lateral approach offers the advantages associated with traditional lateral lumbar interbody fusions (LLIF), such as improved disc space access and disc height restoration while enabling simultaneous access to the posterior column. Additionally, SP allows surgeons to circumvent the logistical inefficiencies associated with patient repositioning. As value-based care becomes a central paradigm in determining treatment indications, cost utility becomes an increasingly important consideration. As such, this study aims to compare the cost-effectiveness of SP versus DP approaches for lumbar interbody fusion.

**Methods:** A retrospective cohort study of patients who underwent lateral-based (LLIF/OLIF) or anterior lumbar interbody fusion (ALIF) with posterior pedicle screw fixation between 2019-2022 at a single institution was conducted. Surgeries were performed among seven spine surgeons, of which two performed SP procedures in addition to customary DP approaches. Cost data (operating room costs, variable costs, total cost of admission), demographic data, complications, operative variables, and surgical details were compared between SP and DP cohorts. Univariate and multivariate analyses, and subgroup analysis were performed to identify independent predictors for increased costs. All costs were adjusted accordingly to 2023 U.S. consumer price index (CPI) data.

**Results:** Overall, 66 patients were included; 41 (63%) underwent DP and 24 (37%) underwent SP. On average, the SP group had shorter mean operative times (354±141 vs. 493±135 minutes; p<0.001) and length of stay (3.3±2.6 vs 4.9±3.1 days; p=0.008) relative to the DP cohort while demonstrating comparable complication rates. Operating room costs (\$9,659±2544 vs \$14,407±4741; <0.001), variable costs (\$29,013±8,932 vs \$39,755±19,347; p=0.002), and total costs (\$38,673±10,477 vs \$54,162±23,269; p<0.001) were significantly lower in the SP group. Subgroup analysis for only single-level fusions (n=35) reaffirmed significant reduction in OR costs (β= -1,406.9; p=0.043) and total admission costs (β= -6,871.6; p=0.005) for patients who underwent SP (Table 1).

**Discussion:** Our results suggest that SP surgery significantly reduces operative time, length of stay, and costs in comparison with traditional DP surgery without increasing complications. While individual surgeon preferences and unaccounted factors may impact cost variations, our study supports that SP surgery may present a cost-effective approach with a comparable safety profile. As more surgeons adopt this technique, tracking potential savings compared to DP surgery will be crucial, thereby providing pragmatic insights to improve outcomes across economic, clinical, and patient-centered domains.

**Significance/Clinical Relevance:** This study establishes that there are significantly lower costs associated with SP technique for lumbar fusion when compared to DP while offering similar safety profiles. These findings introduce a cost-effective strategy that emphasizes patient-centered care and reduces the burden on the healthcare system by reducing OR time and utilization of additional intraoperative resources.

Operating Room Adjusted Costs	β coefficient	Standard Error	t	95% CI	p-value
O-arm	1,119.30	647.86	1.73	-228 to 2,467	0.099
Ileus	2,116.71	1,535.92	1.38	-1,077 to 5,311	0.183
Single Position	-1,406.92	654.46	<b>-2.15</b>	-2,768 to -46	<b>0.043</b>
BMI	176.24	44.05	4.00	85 to 268	<b>0.001</b>
Diabetes	-1,440.09	775.31	<b>-1.86</b>	-3,052 to 172	0.077
ASA	832.91	562.14	1.48	-336 to 2,002	0.153
Isthmic Spondylolisthesis	-1,143.77	712.78	<b>-1.60</b>	-2,626 to 339	0.124
EBL	1.75	0.60	2.94	1 to 3	<b>0.008</b>
Operating Room Time	5.02	2.02	2.48	1 to 9	<b>0.021</b>
Open Decompression	1,345.47	647.87	2.08	-2 to 2,693	0.050
Anesthesia Duration	6.90	3.37	2.05	0 to 14	0.053
BMP	1,269.68	808.11	1.57	-411 to 2,950	0.131
Length of Stay	-305.66	113.64	<b>-2.69</b>	-542 to -69	<b>0.014</b>
Constant	-468.97	2,399.76	<b>-0.20</b>	-5,460 to 4,522	0.847
<b>Other Adjusted Costs</b>					
Open Decompression	-3,955.54	2,021.45	<b>-1.96</b>	-8,111 to 200	0.061
Length of Stay	2,560.56	332.73	7.70	1,877 to 3,244	<b>0.000</b>
Single-Position	-3,179.47	1,815.72	<b>-1.75</b>	-6,912 to 553	0.092
Isthmic Spondylolisthesis	-4,394.54	2,320.43	<b>-1.89</b>	-9,164 to 375	0.069
Allograft	4,391.88	2,166.43	2.03	-61 to 8,845	0.053
Diabetes	5,553.05	2,419.76	2.29	579 to 10,527	<b>0.030</b>
Ileus	-6,868.33	4,657.79	<b>-1.47</b>	-16,443 to 2,706	0.152
Estimated Blood Loss	3.66	1.58	2.31	0 to 7	<b>0.029</b>
Constant	18,875.02	2,119.86	8.90	14,518 to 23,232	<b>0.000</b>
<b>Variable Adjusted Costs</b>					
BMP	5688.591	2533.182	2.25	471 to 10,906	<b>0.034</b>
Allograft	5577.75	2258.385	2.47	927 to 10,229	<b>0.021</b>
Single-Position	-6871.551	2201.443	-3.12	-11,406 to -2,338	<b>0.005</b>
O-arm	4891.955	1996.091	2.45	781 to 9,003	<b>0.022</b>
Length of Stay	2279.722	339.8904	6.71	1,580 to 2,980	<b>0.000</b>
Diabetes	5985.355	2402.082	2.49	1,038 to 10,933	<b>0.020</b>
Isthmic Spondylolisthesis	-4210.656	2193.554	-1.92	-8,728 to 307	0.066
Estimated Blood Loss	7.89065	1.602938	4.92	5 to 11	<b>0.000</b>
Fluoroscopy Time	26.13663	13.00503	2.01	-1 to 53	0.055
Constant	20563.02	3662.975	5.61	13,019 to 28,107	<b>0.000</b>

**Table 1.** Subgroup multiple linear regression analysis including only single-level procedures. A p-value <0.05 is significant. ASA = American Society of Anesthesiologist Physical Status Classification, BMI = body mass index, BMP = bone morphogenic protein, MIS = minimally invasive, OR = operating room.