

Time-Stratified Analysis of Reoperation Rates Following Minimally Invasive and Open Transforaminal Lumbar Interbody Fusion

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INTRODUCTION: Minimally invasive transforaminal lumbar interbody fusion (MI-TLIF) offers outcomes comparable to open TLIF with reduced approach-related morbidity. While previous studies have compared MI-TLIF and open TLIF broadly, few have examined complication-related return to operating room (RTO) rates across specific postoperative intervals. This study evaluates RTO complication timing—early (<6 months), late (6 months–2 years), and long-term (>2 years)—in patients undergoing MI-TLIF versus open TLIF, with consideration of the surgeon learning curve.

METHODS: A retrospective review was conducted on patients who underwent 1- or 2-level open TLIF or MI-TLIF between 2012 and 2018 with a minimum 2-year follow-up. RTOs were identified and stratified by early, late, and long-term time intervals. Subgroup analyses were performed for single-level fusions. Demographics and complication types were compared using binomial and categorical statistical methods.

RESULTS: A total of 423 patients were included (127 open TLIF, 296 MI-TLIF) with comparable mean follow-up (open: 67.9 months; MI-TLIF: 69.6 months, $p=0.633$). Overall RTO rates were similar (MI-TLIF: 10.8% vs. open: 11.8%, $p=0.764$). RTO rates over time for MI-TLIF were 2.4% (early), 5.7% (late), and 2.7% (long-term); for open TLIF they were 5.5%, 0.8%, and 5.5%, respectively. The open group had significantly fewer late pseudarthrosis-related RTOs ($p=0.042$). Subgroup analysis of single-level fusions revealed significantly lower pseudarthrosis and adjacent segment disease (ASD) in the open TLIF group during late and long-term intervals ($p<0.001$). No significant differences in other complication types or overall RTO rates were found. Of 14 pseudarthrosis cases in the MI-TLIF group, 93% occurred in the first two years of the study.

DISCUSSION AND CONCLUSION: MI-TLIF and open TLIF demonstrated similar overall RTO rates. However, pseudarthrosis requiring RTO was more frequent in the MI-TLIF group, particularly during the surgeon's early experience with the technique. The majority of MI-TLIF pseudarthrosis cases occurred within the first two years of the study, highlighting the impact of the learning curve on outcomes. Surgeons should consider experience level when selecting MI-TLIF for patients at increased risk for pseudarthrosis.