Interbody Fusion Techniques for L5-S1 Degenerative Spondylolisthesis: A Comparison of Radiographic Correction and Postoperative Complications

Manjot Singh, Gabriel A Gonzalez, Rhea D Rasquinha, Nicolas L Carayannopoulos, Zvipo M Chisango, Michael Jeremy Farias, Joseph Elias Nassar, Jinseong Kim, Lachlan Kirby, Derrick Kang, Todd Stafford, Eren O Kuris, Bryce A Basques, Bassel Diebo, Alan H Daniels

INTRODUCTION:

Degenerative lumbar spondylolisthesis is a common spinal pathology, especially in the caudal levels, that can contribute to severe pain and functional limitations. Surgical interventions are frequently pursued to decompression the foramen, stabilize the vertebral bodies, and restore sagittal alignment. However, a comparison of the available interbody techniques to manage L5-S1 degenerative spondylolisthesis is lacking.

METHODS:

Adults who underwent one-level interbody fusion for L5-S1 degenerative spondylolisthesis were included in this retrospective cohort study. Patients were stratified by surgical technique: transforaminal lumbar interbody fusion (TLIF), standalone anterior lumbar interbody fusion (ALIF), and combined ALIF + posterior lumbar fusion (ALIF+PLF). Demographics, six-week radiographic spinopelvic alignment, and two-year postoperative complications were compared using univariate and multivariate regression modeling adjusting for age, sex, body mass index (BMI), Charlson Comorbidity Index (CCI), history of spinal fusion, practicing surgeon, surgeon experience, and preoperative L5-S1 slip.

RESULTS: Among 123 included patients, mean age was 55.1 years, 57.7% were female, mean BMI was 30.3kg/m2, and mean CCI was 1.9. After stratification by procedure, mean age (TLIF=59.2, ALIF=48.0, ALIF+PLF=54.3years, p=0.006), BMI (32.3, 28.9, 28.8, p=0.017), and CCI (2.3, 0.8, 1.9, p=0.002) differed across cohorts. Radiographically, preoperative L5-S1 slippage (12.4%, 8.4%, 19.8%, p=0.007) and six-week postoperative ΔPI-LL (0.9º, 3.9º, -4.7º, p=0.002), ΔL5-S1 lordosis (2.9º, 6.2º, 9.1º, p<0.001), and ΔL5-S1 slippage (-8.7%, -12.5%, -22.2%, p<0.001) correction differed across cohorts. Multivariate linear regressions revealed that ALIF patients had comparable correction but ALIF+PLF patients had higher six-week postoperative ΔPI-LL (coeff=-5.8º, p=0.006), ΔL5-S1 lordosis (coeff=4.9º, p=0.001), and ΔL5-S1 slippage (coeff=-7.9%, p<0.001) correction with respect to TLIF patients. Two-year postoperatively, reoperation rates (1.9%, 16.7%, 2.1%, p=0.011) differed across cohorts. Multivariate logistic regressions revealed that ALIF patients had higher odds of pseudoarthrosis/subsidence (OR=14.2, p=0.032) and reoperations (OR=15.7, p=0.50) but ALIF+PLF patients had comparable odds of complications with respect to TLIF patients.

DISCUSSION AND CONCLUSION: In this investigation, ALIF+PLF was shown to be the most effective at correcting spondylolisthesis slip magnitude and segmental alignment. Standalone ALIF and TLIF, on the other hand, demonstrated comparable correction, with standalone ALIF patients experiencing higher rates of pseudoarthrosis/subsidence and reoperations. Combined anterior-posterior support appears beneficial to achieve optimal radiographic and clinical outcomes in patients with L5-S1 degenerative spondylolisthesis.