Cage Stability Following Anterior Column Release Through the Oblique Antepsoas Approach: Is Supplemental Anterior Fixation Mandatory?

Rehan Rizwan Khan, Nader El Hajj, Robert Paul Azario, Aziz Saade, Jason J Zhang, Jude Abiad, Brian Scott Tao, Sara Atassi, Neil V Shah, Olivia Tao Zhou, Chadi A Tannoury, Tony Y Tannoury

INTRODUCTION: Anterior column release (ACR) during the minimally invasive Anterior to the Psoas (MIS-ATP) lumbar fusion is feared for cage dislodgement following the complete release of the anterior longitudinal ligament (ALL). Therefore, the addition of supplemental anterior fixation has been strongly proposed to secure the cage and prevent its migration. However, there are no studies evaluating cage dislodgement in MIS-ATP-ACR spinal fusions. This study sought to assess interbody cages stability following MIS-ATP-ACR performed without anterior fixation, by analyzing the rate of postoperative cages dislodgement or migrations. Moreover, we have identified a subset of cages “at-risk” indicating the interbody implants with any radiographic (biplanar) concern for un-contained portions beyond the confinement of the subjacent endplates; these were also closely observed for any future migrations and revision surgery. Finally, we aimed to analyze whether the presence of anterolateral vertebral osteophytes promote, or protect against, cage migration.

METHODS:

This is a retrospective cohort study of adult patients who underwent MIS-ATP fusions at a single institution between 2007 and 2024. Demographic and clinical data were collected. Radiographs were reviewed to document the initial and final cage positions with at least a 6 month follow up. The portion of the cage un-contained within the disc space was measured in mm. We also assessed and measured the presence of osteophytes at the fused discs. Other outcome measures included hardware failure (rod breakage, screw breakage), screw pull out, and proximal / distal junctional failure(s). Radiographic X-ray magnification was accounted for in every radiograph. Statistical analysis was conducted using univariate and multivariate linear regressions to assess associations with cage migration.

RESULTS:

A total of 3,283 cages (1,492 patients) were analyzed, of which 480 “at-risk” cages were identified in 303 patients. The average age was 58.98±11.70 years with an average BMI of 31.54±6.32. Of these patients, 204 (67.55%) were female, 156 (51.66%) were white, 86 (28.48%) smoked and 83 (27.48%) drank alcohol. The most common indication for surgery was spondylolisthesis (n=150, 49.67%). Of the 480 “at-risk” cages, the most common level was L4-L5 (n=128, 26.78%). There was an average cage migration of 2.84 mm ± 3.48 mm. Of the 3,283 cages, only 3 cages were dislodged, all of which were initially considered cages “at-risk”. Of these 3 cages, 2 fully migrated anteriorly and the other migrated laterally (partial) ipsilateral to the approach side. One of the anteriorly dislodged cages warranted surgical revision. Alcohol consumption status (p=0.035) was associated with increased cage migration, while sex’s association in the univariate (p=0.035) was attenuated once controlling for confounders (p=0.122). As osteophytes size increased, cage migration decreased (p=<0.001). No osteophyte fractures were noted on post-operative imaging.

DISCUSSION AND CONCLUSION: Cage dislodgement is extremely low following the MIS-ATP-ACR without supplemental anterior stabilization. Out of 3,283 total cages examined, 480 (14.56%) were considered “at-risk” radiographically, and only 3 (0.061%) did fully migrate. By increasing the end plate surface area and local bone density, osteophytes were found to be resistant to fracture and protective against cage migration. Observation of “at risk” cages, rather than prompt surgical repositioning, is acceptable given the extremely low incidence of cage dislodgement en-face of the significant morbidity and risks associated with cage revision.