Cage Placement Can Serve as a Superior Predictor of Postoperative Subsidence in Expandable and Static TLIF Cages Rather than Cage Specific Properties

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INTRODUCTION:

Expandable cages (EC) have been shown to increase subsidence without improving complications related to neurological retraction. There are a variety of EC utilized in transforaminal lumbar interbody fusions (TLIF) with differences in expansion mechanisms and corresponding pre- and post-expansion dimensions. However, it is currently unclear how differences in cage design, placement, and expansion mechanisms affect complication rates. This study sought to determine which elements of cage design and surgical technique might serve as predictors of subsidence and other complications following single level TLIFs.

METHODS:

This study was conducted as a retrospective review at a single academic institution. Included cases were performed for patients ≥ 18 years of age, who underwent single-level TLIF with bulletnose cages, and completed a minimum of 1-year follow-up. Patients were divided into groups by cage mechanism: Static cages (SC), Internal EC, Accordion EC, and Shim EC. Subsidence was defined as >2mm endplate breaching on lateral radiographs. Outcome measures included cage characteristics, incidence of complications, and radiographic parameters. Statistical analysis included ANOVA with Tukey post-hoc and Chi-square with significance set to p<0.05. Risk factors for cage subsidence were determined via multivariate logistic regression.

RESULTS:

The final study cohort consisted of 150 patients (23 SC, 66 Internal EC, 20 Accordion EC, and 41 Shim EC). There were no demographic differences between the four cage groups. There were some notable differences between the cage categories though. Accordion EC and Shim EC cages were significantly shorter than SC and Internal EC cages (23.5, 23.5, 26.7, 26.7mm, respectively; p<0.001). Further, Shim EC had a smaller insertion width than SC, Internal EC, and Accordion EC (7.3, 9.6, 10.2, 10.2mm, respectively; p<0.001). Shim EC also had a smaller insertion height than SC, Internal EC, and Accordion EC (7.4, 10.5, 9.3, 10.5mm, respectively; p<0.001). Further, Internal EC and Shim EC had greater expansion distance than Accordion EC or SC (4.2, 4.5, 2.6, 0mm, respectively; p<0.001). Finally, Internal EC had greater cage lordosis than Accordion EC or SC or Shim EC (13.6, 10, 6.6, 6.4, respectively; p<0.001).

Cages were more placed more anterior for Internal EC vs. Shim EC vs. SC (5.0, 8.4, 8.6mm), respectively, with Accordion EC (6.2mm) similar to all groups, p=0.003. Change in disc height was greater for Shim EC than Internal EC, with SC and Accordion EC overlapping both (-6.3, 1.7, -4.0, 0.4mm, respectively; p=0.002). Pseudarthrosis was more frequent in Accordion EC than SC cases, Internal EC, or Shim EC (15%, 4.3%, 3.0%, 0%, respectively; p<0.05). Postoperative subsidence trended lower for SC compared to Shim EC, Internal EC, and Accordion EC (21.7%, 39.0%, 47.0%, 55.0%, respectively p=0.108). Further, adjacent segment disease trended higher for Accordion EC compared to Shim EC, Internal EC, and SC (15.0%, 4.9%, 3.0%, 0.0%, respectively; p=0.097). Incidence of other complications and re-operations were similar between groups.

Following regression analysis, increased distance from cages to the anterior vertebrae was an independent risk factor for post-operative subsidence (OR 1.2, p=0.015). Further, cage height expansion distance trended toward significance as an independent risk factor for intraoperative subsidence (OR 1.6, p=0.054).

DISCUSSION AND CONCLUSION:

In conclusion, placement of TLIF cages more anteriorly is protective of subsidence, suggesting differences in techniques may be a greater contributor to subsidence than cage design, be it an expandable or static cage. Further, no significant predictors of subsidence were identified in relation to cage design or geometry. Future research with greater power is needed to fully elucidate the predictors of subsidence, neurologic complications, and patient outcomes.