

**Minimally-Invasive Lumbar Interbody Fusion With an Expandable Meshed Allograft Containment Device:
Analysis of Subsidence With 12-Month Minimum Follow-Up**

John Paul George Kolcun BS; George M. Ghobrial MD; Kenneth Crandall; Ken Hsuan-Kan Chang MD; Giacomo Pacchiarotti MS; Michael Y. Wang MD, FACS
Department of Neurological Surgery, University of Miami Miller School of Medicine

Introduction

A minimally-invasive allograft-filled expandable meshed-bag containment system can be used in the lumbar spine for interbody fusion. Although graft subsidence is a key factor in selecting any interbody device, subsidence rate has not yet been reported with this device.

Methods

Consecutive adult patients that underwent 1- or 2-level interbody fusion with at least 1 year of radiographic follow-up were included in this study. Preoperative, postoperative, and final follow-up lumbar radiographs were analyzed to measure disc height and neuroforaminal height.

Results

Forty-one patients were identified, with a mean age of 63.4 years (SD ±11.8). A total of 61 levels were treated, with successful fusion observed in 54 levels (88.5%). Demographic details are given in Table 1. The mean radiographic follow-up was 24.3 months (SD ±11.2). Overall, average disc height increased by a net 1.3mm (SD ±2.5, p < 0.001) and average neuroforaminal height increased by a net 1.7mm (SD ±2.8, p = 0.004). Detailed measurements are shown in Tables 2 and 3, as total sample radiographic measurements at baseline, postoperatively, and at most recent follow-up. All values are represented as mean ±SD. All lengths are given in millimeters, and all angles shown in degrees. Comparisons between time-points are shown with results of two-tailed paired student’s t-tests. No significant difference in subsidence was observed between 1- and 2-level surgeries.

Table 1

Demographics	
No. of patients	41
Age (years)	63.4 ±11.8
Sex ratio (M:F)	12 (29.3) : 29 (70.7)
Tobacco use	11 (26.8)
Operative level	
L2/3	2 (4.9)
L3/4	15 (36.6)
L4/5	29 (70.7)
L5/S1	15 (36.6)
Outcomes	
Fusion (levels)	54 (88.5)
EBL (cc)	203.9 ±186.5
LOS (days)	4.3 ±2.3
Complications	1 (2.4)
Follow-up (months)	
Clinical	28.4 ±13.5
Radiographic	24.3 ±11.2

Table 2

	Anterior	Disc height Posterior	Average
Baseline	9.2 ±4.4	5.1 ±2.2	6.9 ±3.2
Postoperative	12.8 ±3.1	8.2 ±2.3	10.1 ±2.9
Change from baseline	3.3 ±2.7	2.9 ±2.2	3.1 ±1.9
% Change from baseline	56.9	87.2	66.5
p-value	< 0.001	< 0.001	< 0.001
Final	10.8 ±2.5	6.6 ±2.0	8.3 ±2.4
Change from post-op	-2.0 ±2.0	-1.5 ±1.8	-1.8 ±1.7
% Change from post-op	-15.0	-17.1	-15.5
p-value	< 0.001	< 0.001	< 0.001
Net changes			
Change from baseline	1.3 ±3.4	1.4 ±2.6	1.3 ±2.5
% Change from baseline	34.6	57.9	42.8
p-value	0.062	0.002	< 0.001

Table 3

	Foraminal height	Anterolisthesis	Lumbar lordosis	Lumbar Cobb angle	Interbody angle
Baseline	18.0 ±3.3	3.7 ±3.8	40.3 ±14.8	5.4 ±8.2	
Postoperative	20.7 ±3.6	2.2 ±3.0	42.9 ±12.7	4.0 ±6.4	6.7 ±4.3
Change from baseline	3.0 ±3.3	-1.3 ±2.6	0.5 ±12.5	-1.1 ±4.3	—
% Change from baseline	19.1	-29.9	29.8	-14.7	—
p-value	< 0.001	0.004	0.018	0.065	
Final	19.2 ±3.4	—	42.7 ±13.9	4.2 ±6.6	5.9 ±4.4
Change from post-op	-1.3 ±3.4	—	-0.3 ±21.3	0.2 ±2.3	-0.8 ±2.9
% Change from post-op	-4.3	—	-0.4	26.4	-5.2
p-value	0.012		0.689	0.536	0.034
Net changes					
Change from baseline	1.7 ±2.8	-1.3 ±2.6	0.3 ±11.9	-1.1 ±4.3	-0.8 ±2.9
% Change from baseline	11.2	-29.9	14.4	-20.5	-5.2
p-value	0.004	0.004	0.010	0.078	0.034

Figure 1



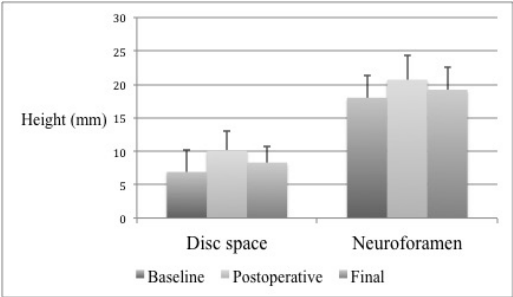
Interbody device

Figure 2



Representative X-ray sequence in a single patient. A: preoperative; B: postoperative; C: long-term follow-up

Figure 3



Total population radiographic findings.
Measurements shown in mm.

Conclusions

An expandable allograft containment system is a feasible alternative for lumbar interbody fusion. Due to its biologic and mechanical characteristics, the surgeon using such constructs should account for an anticipated average 18% loss of interbody height due to subsidence during the bony remodeling/fusion process.

References

- 1.Wang MY. Improvement of sagittal balance and lumbar lordosis following less invasive adult spinal deformity surgery with expandable cages and percutaneous instrumentation. Journal of neurosurgery. Spine. 2013;18(1):4-12.
2. Isaacs RE, Sembrano JN, Tohmeh AG, Group SDS. Two-Year Comparative Outcomes of MIS Lateral and MIS Transforaminal Interbody Fusion in the Treatment of Degenerative Spondylolisthesis: Part II: Radiographic Findings. Spine (Phila Pa 1976). 2016;41 Suppl 8:S133-144.
3. Kim CW, Doerr TM, Luna IY, et al. Minimally Invasive Transforaminal Lumbar Interbody Fusion Using Expandable Technology: A Clinical and Radiographic Analysis of 50 Patients. World neurosurgery. 2016;90:228-235.