Predictors, Rates of Subsidence, and Clinical Outcomes Following Expandable Cage Insertion for MI-TLIF

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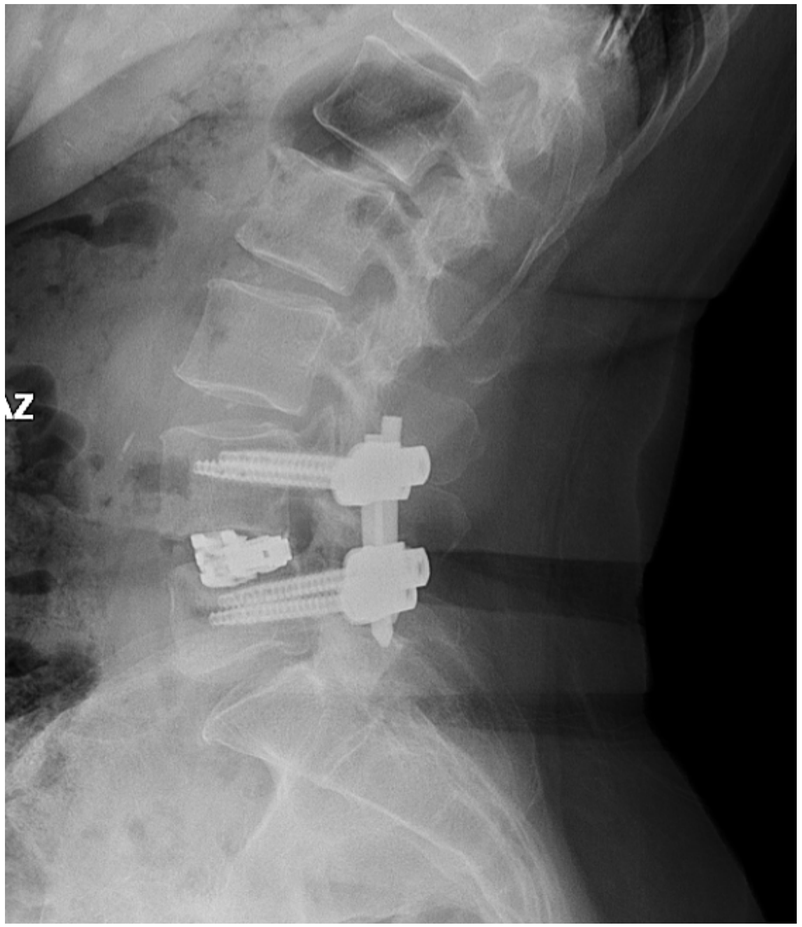
Background

- **Minimally invasive transforaminal lumbar interbody fusion (MI-TLIF)** remains the workhorse fusion approach in the treatment of degenerative lumbar pathology.
  - More recently expandable cage technology has been adopted to reduce the risk of neurologic injury and optimize indirect decompression, sagittal alignment, and fusion.
- Endplate violation and postoperative cage **subsidence** can be seen
  - This complication is therefore of particular concern when using expandable technology, as the force required to expand the cage can theoretically weaken the adjacent endplates and cause violation.
- While this complication can be quite common for TLIF broadly, the rates of subsidence for MI-TLIF using expandable cage technology remain unknown. Additionally, there is minimal research for the clinical outcomes and predictors of subsidence.



Methods

Study Design: Retrospective Review

Inclusion Criteria: Primary MI TLIF 1 or 2 levels for degenerative disc disease

Imaging requirements: Lumbar XR imaging >6 months post op & immediate post op XR imaging <1 month post op

Exclusion Criteria: Trauma, Prior spine surgery

Radiographic Measurements: Anterior and Posterior Disc Height, Pelvic Incidence, Pelvic Tilt, Segmental Lordosis, Lumbar Lordosis

Primary Outcome: *Rates of subsidence following MI TLIF with expandable cages*

Secondary Outcome:

- *Demographic and radiological predictors of subsidence*
- *Subsidence impact on patient reported outcomes (PROMs)*

Patient Demographics & Subsidence Rates

- 148 total patients
- 121 1-level surgeries, 27 2-level surgeries
- 42 subsided (39%)
- No difference in demographic factories between subsided patients

	Not Subsided	Subsided	p
n	106	42	
Subsided. = 1 (%)	0 (0.0)	42 (100.0)	<0.001
Gender = 1 (%)	53 (50.0)	16 (38.1)	0.26
Race (%)			0.81
African American	5 (4.7)	3 (7.1)	
Asian	5 (4.7)	1 (2.4)	
Caucasian	88 (83.0)	36 (85.7)	
Hispanic	2 (1.9)	0 (0.0)	
Other/Unknown	6 (5.7)	2 (4.8)	
ASA (%)			0.329
1	11 (10.4)	2 (4.8)	
2	90 (84.9)	36 (85.7)	
3	5 (4.7)	4 (9.5)	

Demographic Factors Predicting Cage Subsidence

- **Average L1 L2 BMD was significantly less for patients that subsided compared to those that did not**
- **Operative time and EBL were also significant between the 2 groups**
- **Higher percent of 2 level patients subsided compared to 1 level patients (not statistically significant)**
- **Subsided patients were on average older (not statistically significant)**

	Not Subsided	Subsided	p
n	106	42	
Smoker = 1 (%)	38 (35.8)	16 (38.1)	0.947
Osteoarthritis = 1 (%)	28 (26.4)	11 (26.2)	1
Osteoporosis = 1 (%)	2 (1.9)	3 (7.1)	0.275
Number.of.Levels = 2 (%)	11 (10.4)	10 (23.8)	0.064
Operative.Level (%)			0.119
L3L4	2 (1.9)	0 (0.0)	
L3L5	1 (0.9)	0 (0.0)	
L4L5	57 (53.8)	23 (54.8)	
L4S1	10 (9.4)	10 (23.8)	
L5S1	36 (34.0)	9 (21.4)	
Fusion = 1 (%)	54 (90.0)	19 (90.5)	1
HospitalComplications = 1 (%)	13 (12.3)	5 (11.9)	1
Reoperation = 1 (%)	2 (1.9)	0 (0.0)	0.915
Age (median [IQR])	61.50 [51.50, 69.00]	66.50 [58.25, 70.00]	0.079
BMI (median [IQR])	26.69 [24.22, 29.79]	27.38 [24.54, 30.43]	0.629
CCI.w..Age (median [IQR])	2.00 [1.00, 3.00]	2.50 [1.25, 3.00]	0.1
Average.L1.L2.BMD (median [IQR])	131.50 [102.62, 170.00]	117.50 [76.57, 146.50]	**0.036**
Operative.Time (median [IQR])	98.00 [82.25, 128.75]	114.50 [95.75, 159.50]	**0.043**
EBL (median [IQR])	50.00 [25.00, 50.00]	50.00 [35.00, 100.00]	**0.005**
LOS (median [IQR])	32.54 [29.00, 52.85]	32.47 [29.58, 52.21]	0.634

Subsidence Impact on Post-Operative Outcomes

- **Patient reported outcomes did not change between the 2 groups at any of the time points collected**

	Not Subsided	Subsided	p
n	106	42	
d6.week.Oswestry.Disability.Index (median [IQR])	-6.00 [-18.00, 6.00]	-12.00 [-34.50, 4.47]	0.23
d6.month.Oswestry.Disability.Index (median [IQR])	-16.00 [-28.00, -5.55]	-17.80 [-34.00, -11.00]	0.315
d1.year.Oswestry.Disability.Index (median [IQR])	-18.00 [-26.00, -6.70]	-18.00 [-34.00, -14.00]	0.679
d6.week.Leg.VAS (mean (SD))	-2.23 (3.49)	-4.16 (3.70)	**0.012**
d6.month.Leg.VAS (median [IQR])	-3.25 [-6.50, -1.00]	-6.00 [-8.00, -2.50]	**0.046**
d1.year.Leg.VAS (median [IQR])	-2.00 [-6.00, 0.00]	-6.00 [-8.00, -1.00]	0.053
d6.week.Back.VAS (mean (SD))	-2.27 (3.07)	-3.17 (3.84)	0.199
d6.month.Back.VAS (mean (SD))	-2.99 (2.82)	-3.74 (3.72)	0.304
d1.year.Back.VAS (mean (SD))	-2.33 (3.24)	-2.88 (3.36)	0.485
d6.week.SF.12.Physical.Component.Score (median [IQR])	2.32 [-3.86, 8.24]	-2.08 [-6.27, 7.08]	0.219
d6.month.SF.12.Physical.Component.Score (median [IQR])	9.02 [2.18, 14.30]	10.60 [2.53, 13.40]	0.778
d1.year.SF.12.Physical.Component.Score (median [IQR])	9.68 [3.24, 16.05]	9.43 [-2.51, 16.66]	0.615

Conclusion/Discussion

- 39% of patients subsided following expandable cage insertion in MI-TLIF procedures
- Bone Mineral Density was significantly lower in patients who subsided compared to those that did not
- EBL and Operative time were both significantly higher in patients who subsided compared to those that did not
- Older patients and those with two level surgeries subsided at higher rates
- Subsidence does not seem to affect patient reported outcomes