# Is there a Correlation Between Degree of Facet Degeneration and Increase in Spinal Canal Volume after a Minimally Invasive Pre-psoas Interbody Fusion? A Minimum 2-Year Follow-Up Study

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INTRODUCTION:

The first stage of circumferential minimally invasive (cMIS) correction of adult spinal deformity (ASD) involves lateral or oblique lumbar interbody fusion (OLIF). These techniques indirectly decompress the spinal canal, lateral recess, and neural foramen and subsequently resolve the radicular symptoms when properly performed. However, one of the surgeons' concerns has been the presence of facet arthropathy which may impede the success of an interbody fusion that is not supplemented by a posterior decompression or facetectomy. In this study, we assessed the clinical and radiological success of the indirect decompression after CMIS correction for ASD.

METHODS:

We review our prospectively collected data registry of 254 ASD patients who underwent staged CMIS correction from Jan 2011 to Jan 2020. Inclusion criteria of having ASD (Cobb>20,SVA>50mm,(PI-LL)>10) and 3+ levels fused, identified 147pts. In total, 104 pts who had at least 2-yr FU with preop and postop lumbar MRI/CT scans for evaluating facets and spinal volume on each lumbar level (L1-S1) were included for this study. Total of 824 facets were reviewed, and we assigned a preop grade (0-3) to the severity of the facet arthropathy (Table 1). We then assessed the success of the indirect decompression by evaluating spinal canal volume on postop MRI/CT scans.

RESULTS:

Mean age was 66.6 (22-84). Mean follow up was 69 months (24-132). Total of 412 interbody levels were fused. Table 2 shows the grading of 824 facets in each lumbar level (L1-S1). All preop clinical parameters, including the visual analog scale score (5.9, 2-10, SD 2) and Oswestry Disability Index (42.1, 0-78, SD 16.4) significantly improved postoperatively to (2.8, 0-7, SD 2.6) and (28.8, 0-62, SD 20) respectively. The radiological evaluation showed that the spinal canal volume (Table 3) was significantly improved at all lumbar levels (p<0.05) after LIF surgery. Only 4 patients had the same radiculopathy as preop and underwent revision decompression surgery during the second stage. Of these 4 patients needing decompression, 1 patient had a Grade 3 facet, 2 patients had Grade 2 facets, and 1 other patient had Grade 1 facets.

DISCUSSION AND CONCLUSION:

Our study suggests that if the facets are not fused, the success of lateral/oblique interbody fusion in cMIS for ASD is independent of the severity of facet arthropathy posteriorly.

**Table 1:**
Grading of lumbar facet joint degeneration using CT/ MRI described by Weishaupt et al.

| Facet Grade | Definition | N= |
|---|---|---|
| Grade 0 | Normal facet joint space (2–4 mm width) | 51 |
| Grade 1 | Narrowing of the facet joint space (<2 mm) and/or small osteophytes and/or mild hypertrophy of the articular process | 218 |
| Grade 2 | Narrowing of the facet joint space and/or moderate osteophytes and/or moderate hypertrophy of the articular process and/or mild subarticular bone erosions | 404 |
| Grade 3 | Narrowing of the facet joint space and/or large osteophytes and/or severe hypertrophy of the articular process and/or severe subarticular bone erosions and/or subchondral cysts | 151 |

**Table 2: Facet Grading**

| Level | Grade 0 | Grade 1 | Grade 2 | Grade 3 | Total |
|---|---|---|---|---|---|
| L1-L2 | 8 | 35 | 71 | 8 | 122 |
| L2-L3 | 7 | 58 | 88 | 23 | 176 |
| L3-L4 | 13 | 45 | 98 | 40 | 196 |
| L4-L5 | 10 | 50 | 81 | 37 | 178 |
| L5-S1 | 13 | 30 | 66 | 43 | 152 |

**Table 3: Spinal Cross-sectional area**

| | Total LIF done | Pre-op | Post-op | P value |
|---|---|---|---|---|
| L1-L2 | 61 | 2.3 (1.1-3.7) SD 0.64 | 3.4 (2.1-5.1) SD 0.69 | P< 0.05 |
| L2-L3 | 88 | 1.97 (0.83-4.10) SD 0.66 | 3.44 (1.9-5.8) SD 0.83 | P< 0.05 |
| L3-L4 | 98 | 1.82 (1-3.70) SD 0.63 | 3.53 (1.9-6.5) SD 0.89 | P< 0.05 |
| L4-L5 | 89 | 1.95 (1-4.9) SD 0.7 | 3.86 (2-6) SD 0.84 | P< 0.05 |
| L5-S1 | 76 | 2.50 (1.1-5.3) SD 1.09 | 5.08 (2.7-7.5) SD 1.05 | P< 0.05 |

**Table 4: Spina volume Outcomes in pre-op Grade 1 Facets**

| | Pre-op | Post-op | P value |
|---|---|---|---|
| L1-L2 | 2.5 (1.3-3.2) SD 0.6 | 3.6 (2.8-4.5) SD 0.6 | P< 0.05 |
| L2-L3 | 2 (0.8-4.1) SD 0.89 | 3.6 (2.4-5.4) SD 0.95 | P< 0.05 |
| L3-L4 | 2 (1.1-3.1) SD 0.61 | 3.9 (2.9-5) SD 0.64 | P< 0.05 |
| L4-L5 | 2.1 (1.3-3.9) SD 0.92 | 3.7 (2.8-5.2) SD 0.65 | P< 0.05 |
| L5-S1 | 2.1 (1.2-3.7) SD 0.88 | 5.1 (3.6-6.1) SD 0.85 | P< 0.05 |

**Table 5: Spina volume Outcomes in pre-op Grade 2 Facets**

| | Pre-op | Post-op | P value |
|---|---|---|---|
| L1-L2 | 2.3 (1.2-3.7) SD 0.5 | 3.4 (2.1-5.1) SD 0.7 | P< 0.05 |
| L2-L3 | 2 (0.8-3.3) SD 0.61 | 3.5 (2-5.8) SD 0.73 | P< 0.05 |
| L3-L4 | 1.6 (1-3.4) SD 0.54 | 3.4 (2.1-6.5) SD 0.82 | P< 0.05 |
| L4-L5 | 2 (1.1-3.6) SD 0.60 | 4.1 (2.1-6) SD 0.85 | P< 0.05 |
| L5-S1 | 2.4 (1.1-5.3) SD 1.1 | 5.5 (3.2-7.5) SD 1.3 | P< 0.05 |

**Table 6: Spina volume Outcomes in pre-op Grade 3 Facets**

| | Pre-op | Post-op | P value |
|---|---|---|---|
| L1-L2 | 2.3 (1.2-3.5) SC 0.9 | 2.9 (1.9-3.6) SD 0.5 | P< 0.05 |
| L2-L3 | 1.8 (1-3) SD .54 | 3.2 (2.2-5.2) SD 0.89 | P< 0.05 |
| L3-L4 | 2.1 (1-3.7) SD 0.68 | 3.6 (1.9-5.3) SD 0.91 | P< 0.05 |
| L4-L5 | 3.4 (2.3-4.2) SD 0.55 | 5.1 (3.2-7.5) SD 1.2 | P< 0.05 |
| L5-S1 | 2.8 (1.3-4.8) SD 1.04 | 4.8 (2.7-6.2) SD 0.80 | P< 0.05 |