Coronal Cobb Angle Correction with Pre-psoas (Oblique) and Lateral Lumbar Interbody Fusion in Adult Scoliosis Patients

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Introduction

• Lateral lumbar interbody fusion (LLIF) and oblique (pre-psoas) lumbar interbody fusion (OLIF) can be used to treat adult scoliosis. However, few studies have compared coronal Cobb angle correction with LLIF versus OLIF. We evaluated Cobb angle correction in patients with adult scoliosis who underwent OLIF and LLIF.
Methods

A retrospective study of scoliosis patients undergoing multi-level OLIF or LLIF by 5 spine surgeons at our hospital from 2013 to 2018 was performed. Data collected included demographic variables, approach-related factors such as operative time, blood loss, and coronal Cobb angle changes. A two-tailed t-test and a two-tailed z-test were used to compare the data collected for the two techniques. Patients with posterior osteotomies were excluded.
Results

• 57 patients met inclusion criteria: 28 LLIF patients (78 levels) and 29 OLIF patients (65 levels).

• 8 males and 21 females in the LLIF group and 11 males and 19 females in the OLIF group.

• The mean global coronal Cobb angle changes for LLIF were 3.78° ± 2.30, 6.44° ± 8.87, 7.66° ± 4.97, and 9.00 ± 1.00 for one level, two level, three level, and four level procedures, respectively.

• The mean global coronal Cobb angle changes for OLIF were 3.00° ± 3.08, 1.83° ± 2.67, 4.91° ± 5.40, and 4.86 ± 5.14 for one level, two level, three level, and four level procedures, respectively.

• The average global Cobb angle changes for all levels were 3.96° ± 4.75 and 5.14° ± 4.18 for LLIF and OLIF, respectively.

• Each procedure had statistically significant differences in global Cobb angle change individually (p = 0.0472 and 0.0142 for LLIF and OLIF, respectively). However, there was no statistically significant difference between the two approaches when evaluating all of the levels.
combined (p = 0.336) or by matching them by the number of levels performed (one level p = 0.710; two levels p = 0.199; three levels p = 0.275; four levels p = 0.715). [Table 1]

<table>
<thead>
<tr>
<th>Global Coronal Cobb Angle Changes</th>
<th>LLIF</th>
<th>OLIF</th>
<th>p (Levels Matched)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Level</td>
<td>3.78 ° ± 2.30</td>
<td>3.00 ° ± 3.08</td>
<td>0.710</td>
</tr>
<tr>
<td>2 Levels</td>
<td>6.44° ± 8.87</td>
<td>1.83° ± 2.67</td>
<td>0.199</td>
</tr>
<tr>
<td>3 Levels</td>
<td>7.66° ± 4.97</td>
<td>4.91° ± 5.40</td>
<td>0.275</td>
</tr>
<tr>
<td>4 Levels</td>
<td>9.00 ± 1.00</td>
<td>4.86 ± 5.14</td>
<td>0.715</td>
</tr>
<tr>
<td>Combined</td>
<td>3.96° ± 4.75</td>
<td>5.14° ± 4.18</td>
<td></td>
</tr>
<tr>
<td>p (LLIF &amp; OLIF)</td>
<td>0.0472*</td>
<td>0.0142*</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.
The mean segmental coronal Cobb angle changes for LLIF at levels L1-L2, L2-L3, L3-L4, and L4-L5 were 2.56° ± 3.17, 2.70° ± 3.56, 1.50° ± 2.81, and 2.48° ± 4.84, respectively.

The degree changes for OLIF at L1-L2, L2-L3, L3-L4, and L4-L5 were 9.00° ± 1.41, 6.76° ± 7.91, 1.92° ± 6.70, and 3.38° ± 5.59, respectively.

Using a Student’s t-test, both LLIF and OLIF were found to have a significant impact on segmental coronal Cobb angle changes at the L2-L3 level (p = 0.0469 and p = 0.00268, respectively).

A statistically significant difference in segmental Cobb angle change was also found for the L1-L2 level when comparing the two techniques (p = 0.0123), with OLIF creating larger corrections on average (LLIF = 2.56°; OLIF = 9°).

The average change for all levels was 2.19° ± 3.65 (-7° - 12°) and 3.89° ± 6.79 (-8° – 25°) for LLIF and OLIF, respectively.

Each procedure had statistically significant differences in segmental Cobb angle change individually (p = 0.00142 and 0.0000705 for LLIF and OLIF, respectively). However, there was no statistically significant difference when comparing the two (p = 0.0625). [Table 2]
<table>
<thead>
<tr>
<th>Segmental Coronal Cobb Angle Changes</th>
<th>L1-L2</th>
<th>L2-L3</th>
<th>L3-L4</th>
<th>L4-L5</th>
<th>p (Combined)</th>
<th>Average Change Combined</th>
<th>p (Average Change LLIF vs. OLIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLIF Average Change</td>
<td>2.56° ± 3.17</td>
<td>2.70° ± 3.56</td>
<td>1.50° ± 2.81</td>
<td>2.48° ± 4.84</td>
<td>0.00142*</td>
<td>2.19° ± 3.65</td>
<td>0.0625</td>
</tr>
<tr>
<td>p (Individual levels) LLIF</td>
<td>0.187</td>
<td>0.0469*</td>
<td>0.204</td>
<td>0.0756</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLIF Average Change</td>
<td>9.00° ± 1.41</td>
<td>6.76° ± 7.91</td>
<td>1.92° ± 6.70</td>
<td>3.38° ± 5.59</td>
<td>0.0000705*</td>
<td>3.89° ± 6.79</td>
<td></td>
</tr>
<tr>
<td>p (Individual levels) OLIF</td>
<td>0.0565</td>
<td>0.00268*</td>
<td>0.14</td>
<td>0.0514</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p (Individual levels) LLIF vs. OLIF</td>
<td>0.0122*</td>
<td>0.0634</td>
<td>0.773</td>
<td>0.578</td>
<td></td>
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</tr>
</tbody>
</table>

Table 2.
Discussion

• Preoperative and postoperative coronal imbalance has been shown to be associated with increased pain, increased loss of function, and decreased quality of life.

• Average preoperative and postoperative angle changes and their ranges for both procedures were slightly larger than those reported in literature.

• There was no difference in angle correction between the two techniques, which is in contrast to studies suggesting LLIF is superior.

• Small sample sizes, variations in operations, and segmental matching for analysis limit this study and may account for the contrast between the literature and our results.
Summary Points

• LLIF and OLIF both resulted in significant decreases in global and segmental coronal Cobb angles, which is consistent with reports in the literature.

• OLIF may cause greater angle changes than LLIF, but there was no statistically significant difference in segmental or global coronal Cobb angle changes when comparing the two techniques.

• LLIF and OLIF had a significant impact on angle changes at the L2-3 level individually, and LLIF had a significantly greater impact on angle changes at the L1-2 level.

• Further studies need to be done to determine if one technique has a significantly greater capacity for coronal Cobb angle correction than the other.