Impact of the cage position on the lumbar segmental lordosis after lateral lumbar interbody fusion

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Objective

To acquire enough segmental lordosis especially in lower lumbar area is important for good sagittal balance. The aim of the study is to decide the factors affecting lumbar segmental lordosis after minimally invasive lumbar interbody fusion (XLIF or OLIF)
Methods

Patients: A total of 60 patients with degenerative lumbar diseases (Male 26, Female 34, Age 16-85)

Surgery: 91 levels of XLIF or OLIF with percutaneous pedicle screw fixation from 2012 to 2014

Inclusion criteria: Fixation within 3 levels

Exclusion criteria: Vertebral fracture, Obliquely inserted cage more than 10 degrees.
Methods

**Image analysis:** Computed tomography (CT) before and 2 weeks after the surgery

**Image parameters:**
- **Pre-SLA** (preoperative segmental lumbar lordotic angle)
- **Post-SLA** (postoperative segmental lumbar lordotic angle)
Methods

Image parameters:
DiscH (disc height)

CageP (cage position: The distance between the center of the disc space and the center of the cage)

Cage parameters:
CageH (cage height)
CageA (cage angle (6° or 10°))

Other parameters:
Level fused (L2/3, L3/4, and L4/5)

Statistics: Pearson’s correlation coefficient, or Spearman’s rank correlation coefficient. Multivariable linear regression analysis
Results

Average Post-SLA increased significantly from Pre-SLA at all levels.

Post-SLA was greater in the 10° cages than in the 6° cages, but not statistically significant.

Plot of Means

Cage A

- 6°
- 10°
Results

CageP had a strong correlation with Post-SLA ($r = 0.63$, $p < 0.01$), and Pre-SLA had also a strong correlation with Post-SLA ($r = 0.61$, $p < 0.01$). Interestingly, Post-SLA was smaller than Pre-SLA in 21 of the 91 levels (green dots).
CageH and DiscH did not have any significant correlation with Post-SLA
# Results

## Multiple Regression Analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>P</th>
<th>vif</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.077</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CageP</td>
<td>0.640</td>
<td>0.0582</td>
<td>0.598</td>
<td>&lt;0.001</td>
<td>1.003</td>
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<tr>
<td>Pre-SLA</td>
<td>0.645</td>
<td>0.0605</td>
<td>0.580</td>
<td>&lt;0.001</td>
<td>1.004</td>
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<tr>
<td>CageA</td>
<td>0.257</td>
<td>0.123</td>
<td>0.114</td>
<td>0.040</td>
<td>1.002</td>
</tr>
</tbody>
</table>

* B: Unstandardized regression coefficient  
* SE: Standard Error  
* β: Standardized regression coefficient  
* vif: Variance inflation factor  
* R²: Coefficient of determination

We adopted Pre-SLA, DiscH, CageP, CageA, CageH, and level fused as independent variables. The analysis showed that the model using three independent variables, namely CageP, Pre-SLA, and CageA, was the final model, and the adjusted coefficient of determination was 0.734.
Results

Post-SLA can be predicted accurately by three independent variables: CageP, Pre-SLA, and CageA.

Post-SLA = 1.077 + 0.640 \times \text{CageP} + 0.645 \times \text{Pre-SLA} + 0.256 \times \text{CageA}
Discussion

To acquire enough post-SLA, cage should be inserted anteriorly as much as possible.

Limitations

1. This study did not consider the size and the shape of vertebrae.
2. Cage variation was limited (only two types of cages, 6° and 10°, and the width was only 18 mm).
Conclusion

Post-SLA can be predicted accurately by three independent variables: CageP, Pre-SLA, and CageA, and CageP and Pre-SLA have strong impact on the Post-SLA. To acquire enough post-SLA, cage should be inserted anteriorly as much as possible.