Sagittal Imbalance might be a Risk Factor of Increasing Post Laminoplasty Kyphosis

Dept. of Orthopedic and Spine Surgery, Meijo Hosp., Nagoya, Japan

Yoshitaka Suzuki, Tetsuya Ohara, Taichi Tsuji, Toshiki Saito, Ayato Nohara, Ryoji Tauchi, Noriaki Kawakami

All of us have no financial relationships to disclose
Introduction

Post Laminoplasty Kyphosis Risk Factors

- Facet joint and nuchal ligament injury
  - John KR 2003
- Detachment of semispinalis from the C2
  - Takeshita 2005
- Preoperative kyphosis
  - Machino 2012
- Higher T1 slope
  - Kim 2013

Regional Factor only!

Compensatory Mechanisms
  Keep Sagittal Balance

Taking into consideration, Whole Spinal Alignment!
Objectives

1. To analyze the change of sagittal cervical alignment preoperative and post laminoplasty

2. To determine the correlation of changes on C2-C7 sagittal alignment and whole spinal sagittal parameters preoperative and post laminoplasty

Demographics

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<tbody>
<tr>
<td><strong>Year of Surgery</strong></td>
<td>2008.3~2012.11</td>
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<tr>
<td><strong>Gender</strong></td>
<td>male 53  female 28</td>
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<tr>
<td><strong>Age</strong></td>
<td>64.7 ± 11.1</td>
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✓ Retrospective Study
✓ 81 Cases ( > 2 years Follow up)
Methodology

Lateral radiograph sagittal parameters

- Cervical lordosis (CL)
- Thoracic kyphosis (TK)
- Lumbar lordosis (LL)
- Sagittal Vertical Axis (SVA) (C2-7 SVA, C7 SVA)
- Pelvic Incidence (PI)

Study 1

Group classification of cervical sagittal alignment

- Lordosis: < -5°
- Kyphosis: -5° ~ 5°
- Neutral: > 5°

Cobb angle change: cervical sagittal alignment

81

Before - 2yrs after surgery

Lordosis: −
Kyphosis: +

2yrs postoperative
Study 2

✓ C2-7 changes : $\beta - \alpha$ : post-pre (Cobb angle)

✓ Sub group category of C2-7 changes sagittal alignment
✓ We compared each groups differences of whole spinal sagittal parameters

- **Lordotic change** > -10°
  - (Increasing lordosis)
  - TK, LL, SS
  - plumb line
  - SVA

- **No change** -10° ~ 10°
  - TK, LL, SS
  - plumb line
  - SVA

- **Kyphotic change** > +10°
  - (Increasing kyphosis)
  - TK, LL, SS
  - plumb line
  - SVA
Results: Study 1
Change of cervical sagittal alignment by Cobb angle

- Lordosis: —
- Kyphosis: +

Change of average Cobb angle (C2-7)

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre op</th>
<th>Post op</th>
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<tr>
<td>Lordosis group (-5) n=46</td>
<td>-16.2</td>
<td>-11.4</td>
</tr>
<tr>
<td>Neutral group (-5~5) n=24</td>
<td>-0.26</td>
<td>2.52</td>
</tr>
<tr>
<td>Kyphosis group (5&lt;) n=10</td>
<td>15</td>
<td>11.6</td>
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- Horizontal line: preoperative cervical cobb angle
- Vertical line: post operative cobb angle

Average Cobb angle  \(-8.2 \pm 13.8 \rightarrow -4.9 \pm 14.7\)

Increased Cobb angle  \(47/81\) 58%
Results: Study 2

Lordotic change n=9
No change n=54
Kyphotic change n=18

Lordotic change group showed younger age and large preoperative C2-7 Cobb angle
This figure revealed the correlation of total sagittal parameters and change in C2-7 Cobb angle, that increase in kyphosis group showed less lumber lordosis, large C7 SVA, and C2-7 SVA compared to other groups.
In preoperative kyphosis group showed decrease in kyphosis. Patients who are symptomatic in lordosis prefer to keep kyphosis to prevent occurrence of symptoms? Further studies are necessary.

Kyphotic change group showed older patients, large preoperative lordosis and sagittal malalignment. Given by our results, our hypothesis is that compensatory mechanisms keep sagittal balance, and after operation it is difficult to keep the head in extended position because of disruption of the static and dynamic stabilizer of the posterior cervical spine, so compensatory mechanism might failed.
Conclusion

- Preoperative whole spinal sagittal imbalance might be a risk factor: increasing post laminoplasty kyphosis
- Post laminoplasty kyphosis: correlate not only regional factor but whole spinal alignment
- Consider effect of whole sagittal parameters as potential factor on changes of cervical alignment postlaminoplasty