Radiographic Dimensional Analysis of Open Door Laminoplasty with Plate in Cervical Spondylotic Myelopathy

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• **Open door laminoplasty**
  - Widely adopted to option of posterior decompression method in *cervical spondyotic myelopathy (CSM)*
  - **Spring back phenomenon**: hinge closing (6%) \(\text{(Wang et al TSJ 2011)}\)

- **Rigid plate fixation** come into the spotlight
  - ↓ hinge closure and restenosis

• Few study that investigated dimensional benefit regarding
  - **Which side opening** would be better??

**If.....**

• Increase of dimension: Open side > Hinge side
  - → Symptomatic dominant side opening is better
To analyze radiological dimensional change of single door cervical laminoplasty with pre-contoured plate using CT scan.

1. **Dimension, Diameter**
   Preoperative vs Postoperative

2. **Identify proper hinge angle**

3. **Symptomatic (Open side) vs. Non-symptomatic (Hinge side)**
**Material and method**
- Open door laminoplasty using plate
- **23 cases** of CSM patients to perform [preop CT & Postop CT](#)
- 81 Lamina
- M:F= 18:5
- Mean age : 62 years (Range; 30-80)

- Evaluation by **2-dimensional CT** (pre-, post-operative)
  1. Diameter
  2. Dimension of entire cross section area
  3. Dimension of both hinged and opened side
  4. Hinge angle

**Operative procedure**
- According to the symptoms → opening side were decided
- Lamina opening with lamina spreader until proper angle
- Attachment of plate to lamina and lateral mass → maintain open door

**Statistical analysis**
- Analysis **difference of Diameter & Dimension** according to **Hinged angle**
  Categorized into 2 Groups (I, II)
    - I : Hinged angle < 10°
    - II : Hinged angle > 10°
  Categorized into 3 Groups (A,B,C)
    - A : Hinged angle < 10°
    - B : Hinged angle : 10~20°
    - C : Hinged angle : 20~30°
### Results

- **Hinge angle after single door cervical laminoplasty. (Mean±SD)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Single door cervical laminoplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge angle</td>
<td>17.2±8.8°</td>
</tr>
</tbody>
</table>

- **Comparison of diameter and dimension between preoperative and postoperative in single door cervical laminoplasty. (Mean±SD)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Laminoplasty with plate</th>
<th>Correction %</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preoperative</td>
<td>Postoperative</td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>10.11± 1.01mm</td>
<td>14.57±1.61 mm</td>
<td>44.8</td>
</tr>
<tr>
<td>Dimension</td>
<td>202.4± 23.0mm²</td>
<td>303.7±45.8mm²</td>
<td>50.5</td>
</tr>
<tr>
<td>Hinged side</td>
<td>100.1±13.1mm²</td>
<td>141.1±21.8 mm²</td>
<td>44.4</td>
</tr>
<tr>
<td>Opened side</td>
<td>102.2±12.4mm²</td>
<td>162.2±27.6 mm²</td>
<td>62.5</td>
</tr>
</tbody>
</table>
A, Hinged angle
B, Difference of diameter between pre- and post- op data in CT
C, Difference of dimension between pre- and post- op data in CT
D, Difference of opened side dimension between pre- and post- op data in CT
E, Difference of hinged side dimension between pre- and post- op data in CT

### Results

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>P value</td>
<td>0.528</td>
<td>0.492</td>
<td>0.709</td>
<td>0.190</td>
<td>0.272</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>16</td>
<td>4.08±1.05</td>
<td>87.7±33.3</td>
<td>56.4±25.0</td>
<td>30.1±16.1</td>
<td>14.5±10.2</td>
</tr>
<tr>
<td>C4</td>
<td>22</td>
<td>4.41±1.24</td>
<td>102.6±33.8</td>
<td>61.7±22.8</td>
<td>41.1±15.4</td>
<td>17.1±8.5</td>
</tr>
<tr>
<td>C5</td>
<td>23</td>
<td>4.45±1.76</td>
<td>104.7±35.2</td>
<td>63.4±22.6</td>
<td>41.7±17.5</td>
<td>17.2±7.7</td>
</tr>
<tr>
<td>C6</td>
<td>20</td>
<td>4.82±1.51</td>
<td>106.5±49.2</td>
<td>66.8±32.3</td>
<td>40.2±20.1</td>
<td>20.4±8.8</td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>4.46±1.44</td>
<td>101.3±38.3</td>
<td>62.4±25.6</td>
<td>38.9±17.6</td>
<td>17.4±8.8</td>
</tr>
</tbody>
</table>

No distinct difference from C3 to C6
### Results

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Increase rate of diameter</th>
<th>Increase rate of dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P value</strong></td>
<td></td>
<td><strong>0.039</strong></td>
<td><strong>0.033</strong></td>
</tr>
<tr>
<td>Group I</td>
<td>21</td>
<td>0.38 ± 0.18</td>
<td>0.41 ± 0.14</td>
</tr>
<tr>
<td>Group II</td>
<td>60</td>
<td>0.47 ± 0.15</td>
<td>0.53 ± 0.18</td>
</tr>
</tbody>
</table>

- Group I: hinge angle below 10°
- Group II: hinge angle above 10°

Group II > Group I
(Diameter & Dimension)
Results

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<th>Increase rate of diameter</th>
<th>Increase rate of dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>P value</td>
<td>0.081</td>
<td>0.056</td>
</tr>
<tr>
<td>Group B</td>
<td>33</td>
<td>0.43±0.13</td>
</tr>
<tr>
<td>Group C</td>
<td>27</td>
<td>0.49±0.17</td>
</tr>
</tbody>
</table>

- Group B: hinge angle 10 ~ 20°
- Group C: hinge angle 20 ~ 30°

Between Group B and Group C - No definite difference
Conclusions

- Open door laminoplasty with plate
  - Increasing dimension (50.5%) and diameter of spinal canal (4.46mm)

- Laminoplasty: should be performed from 10~20° of hinge angle
  → Excessive angle lead to complication and no advantage of dimension between 10~20° and 20~30°

- Increase of dimension
  - Symptomatic side (open side) > Non-symptomatic side (hinge side)
  → opening of symptomatic side have advantage

References

Disclosure

- Nothing to disclosure