Risk factors of poor surgical outcome in posterior decompression and instrumented fusion for thoracic ossification of the posterior longitudinal ligament

Shiro Imagama, Kei Ando, Kazuyoshi Kobayashi, Naoki Ishiguro

Department of Orthopaedic and Spine Surgery
Nagoya University Graduate School of Medicine,
Nagoya, JAPAN
No funds were received in support of this work.
We have nothing to declare conflict of interest.
Surgery for thoracic ossification of the posterior longitudinal ligament (T-OPLL) is still challenging.

The objective was to evaluate significant factors of surgical outcomes after posterior decompression and instrumented fusion for beak type T-OPLL to analyze the appropriate surgical timing.
**Patients and Methods**

- consecutive patients who underwent this surgery for beak type T-OPLL
- Prospective study
- Single institute

73 pts

(37 males and 36 females, mean age 53 years old, mean body mass index [BMI] 32 kg/m²)

**Outcome**
Surgical outcomes were defined as good and poor based on ≥50% and <50% recovery rates for the Japanese Orthopaedic Association (JOA) score at final follow-up at a minimum of 2 years.

**Related factors**
Preoperative characteristics, physical examinations, and findings on plain radiography, CT and MRI including spinal kyphotic alignment difference were compared between patients with good and poor outcomes.

**Statistical analysis**
Multivariate logistic regression analysis was performed to identify significant factors for a poor outcome.
# Results

## Related factors in patients with good and poor outcomes

<table>
<thead>
<tr>
<th>Item</th>
<th>Good (n=54)</th>
<th>Poor (n=17)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative non-ambulatory status (%)</td>
<td>35.2% (19)</td>
<td>76.5% (13)</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Positive finding in a preoperative PST (%)</td>
<td>24.1% (13)</td>
<td>88.2% (15)</td>
<td>P&lt;0.0005</td>
</tr>
<tr>
<td>OPLL-CDR (%)</td>
<td>58.0 ± 11.0</td>
<td>68.8 ± 12.1</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>OPLL-SKAD (UIV to LIV) (°)</td>
<td>0.77 ± 2.9</td>
<td>3.4 ± 2.0</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Beak type OPLL and OLF at same level (%)</td>
<td>33.3% (18)</td>
<td>70.6% (12)</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Beak type OPLL, OLF and HIA at same level (%)</td>
<td>24.1% (13)</td>
<td>70.6% (12)</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Estimated Blood Loss</td>
<td>834.8 ± 771.4</td>
<td>1405.3 ± 863.0</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Intraoperative spinal cord floating (+) in ultrasonography (%)</td>
<td>87.0% (47)</td>
<td>23.5% (4)</td>
<td>P&lt;0.0005</td>
</tr>
<tr>
<td>No deterioration of IONM at the end of the operation (%)</td>
<td>48.1% (26)</td>
<td>17.6% (3)</td>
<td>P&lt;0.0005</td>
</tr>
<tr>
<td>Postoperative complication (°)</td>
<td>25.9% (14)</td>
<td>52.9% (9)</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

*No other items had significant difference.*

PST: prone and supine position test, CDR: canal diameter ratio, SKAD: spinal cord kyphotic angle difference, HIA: high intensity area
### Results

Odds ratios (OR) with 95% confidence interval (95% CI) for a good surgical outcome in multivariate logistic regression model

<table>
<thead>
<tr>
<th>Item</th>
<th>OR</th>
<th>95% CI</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative PST (preoperative)</td>
<td>17.00</td>
<td>2.62-110.22</td>
<td>P&lt;0.005</td>
</tr>
<tr>
<td>Preoperative ambulatory status</td>
<td>6.05</td>
<td>1.24-29.45</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Absence of beak type OPLL, OLF and HIA at the same level</td>
<td>5.84</td>
<td>1.08-31.51</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Intraoperative spinal cord floating (+) in ultrasonography</td>
<td>4.98</td>
<td>1.01-24.42</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Lower EBL</td>
<td>1.01</td>
<td>1.00-1.01</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>
【Discussion】

• Preoperative non-ambulatory status
• Positive finding in a preoperative PST

<Radiographic factors>
• Large OPLL-CDR on CT
• The high rate of Beak type OPLL and OLF at same level,
• and Beak type OPLL, OLF and HIA at same level on MRI

<Recommendation>
• Surgical intervention should preferably be performed before a patient becomes non-ambulatory.
• We recommend examination of the PST for all cases of T-OPLL preoperatively to avoid neglect of severe spinal cord damage and allow planning of surgery with appropriate timing to increase the chance of a good surgical outcome. (PST: Imagama et al. Neurosurgery 2017)
• Early surgery for patients with these CT or MRI findings (severe spinal cord damage) may be chosen for a good surgical outcome.
OPLL-SKAD: \( b-a \) (Spinal cord Kyphotic Angle Difference)

- The preoperative OPLL-SKAD (UIV to LIV) in the fused area differed significantly between patients with good and poor outcomes.
- A case with a preoperative OPLL-SKAD (UIV to LIV) close to 0 degree is likely to have a good surgical outcome, and this result may be useful in determining the fused area in surgical planning.
- The fused area can be planned such that the preoperative OPLL-SKAD (UIV to LIV) is close to 0 degree in preoperative sagittal T2WI MRI when intraoperative dekyphosis of about 10 degrees is conducted.
- In surgical planning for a case with a large OPLL-SKAD, there may be a need to expand the fused area to achieve preoperative OPLL-SKAD (UIV to LIV) close to 0 degree with planning of dekyphotic correction of about 10 degrees.
Intraoperative dekyphosis procedure is recommended.
If intraoperative ultrasonography shows no floating of the spinal cord from T-OPLL, additional dekyphosis with in situ bending or Ponte osteotomy is useful (Imagama et al. Oper. Neurosurg. 2017)
We perform T-OPLL resection from a posterior approach (RASPA) surgery only for patients with a few levels of beak-type T-OPLL in the first surgery or with postoperative aggravation or no improvement for 3 weeks after posterior decompression and instrumented fusion as an additional second surgery (Imagama et al. Neurosurg. 2017).
【Conclusion】

This study firstly revealed the risk factor of poor surgical outcome including spinal kyphotic alignment difference. We should plan the surgery considering these significant factors to improve surgical outcomes.