Analysis of factors affecting the surgical time in anterior cruciate ligament reconstruction using decision tree analysis

Kengo Harato¹, Shu Kobayashi¹, Kazuya Kaneda¹, Yu Iwama¹, Masaki Nagashima², Takayuki Hasegawa³, Yutaro Morishige¹, Eri Katsuyama⁴, Takashi Toyoda⁵, Yasuo Niki¹

1 Dept. of Orthop. Surg. Keio University School of Medicine, Tokyo, Japan
2 Dept. of Orthop. Surg. IUHW Mita Hospital, Tokyo, Japan
3 Dept. of Orthop. Surg. Tokyo Medical Center, Tokyo, Japan
4 Dept. of Orthop. Surg. Tokyo Metropolitan Health and Medical Treatment Corporation, Ohkubo Hospital, Tokyo, Japan
5 Nishiwaseda orthopedic clinic, Tokyo, Japan
Declaration of Interest

We have no disclosures.

Signed: Kengo Harato
Introduction

- A longer surgical time will lead to postoperative complications in orthopedic surgery.

- According to previous reports, surgeon volume affects a surgical time in anterior cruciate ligament (ACL) reconstruction.

- However, little attention has been paid to factors affecting a surgical time in ACL reconstruction.

- The purpose was to clarify the important factors affecting a surgical time in ACL reconstruction using decision making tree analysis.
Materials

- 105 Knees (52 Females and 53 males, average age 39.3 yrs)
  - Inclusion criteria
    Primary ACL reconstruction
  - Exclusion criteria
    Revision surgery
    Complex meniscal injury

All procedures were done using arthroscopy by 13 surgeons at 7 facilities with a same implant (TightRope RT®, Arthrex).
Evaluations

Factors affecting the surgical time:
- Age
- Gender
- Body mass index (BMI: kg/m$^2$)
- Surgeon annual volume
- Assistant annual volume as a surgeon
- Number of assistants
- Bone tunnel creation method (outside-in, transtibia, transportal)
- Reconstruction procedure (single or double bundle)
Statistical analysis

- Surgeon volume was also classified into two groups.
  ① Annual cases > 50 : Group High Volume (HV)
  ② Annual cases < 50 : Group Non-High Volume (NHV)

Decision tree analysis by CHAID (SPSS Version 24)
surgical time as a dependent variable
others as independent variables.
**Model Summary**

<table>
<thead>
<tr>
<th>Specifications</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growing Method</strong></td>
<td>CHAID</td>
<td></td>
</tr>
<tr>
<td><strong>Dependent Variable</strong></td>
<td>Surgical time</td>
<td></td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td>Age, Sex, BMI, Surgeon, Assistant, Number of Assistant, Ligament, Procedure, SoO, Approach</td>
<td></td>
</tr>
<tr>
<td><strong>Validation</strong></td>
<td>Cross Validation</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Tree Depth</strong></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Minimum Cases in Parent Node</strong></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Minimum Cases in Child Node</strong></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables Included</strong></td>
<td>Surgeon, SoO, Number of Assistant, Approach, Assistant</td>
<td></td>
</tr>
<tr>
<td><strong>Number of Nodes</strong></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><strong>Number of Terminal Nodes</strong></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Decision-making tree

Surgeon volume

Group HV
Reconst. Procedure

Group NHV
Assistant Volume
A graphical representation of an algorithm, illustrating all possible decisions, costs, utility, and consequences of an issue.

From the present study

The important factor affecting the surgical time was different among the surgeon groups.

**Group HV**
1. Reconst. Procedure (S or D)
2. Number of Assistants
3. Approach (Outside in or not)

**Group NHV**
1. Assistant Volume
2. Number of Assistants
3. Approach (Outside in or not)
Limitations

• Clinical results were not reported.
• The present study was retrospective.
Summary

• From the present study, the most important factor affecting a surgical time was surgeon volume.

• To reduce a surgical time, reconstruction procedure, bone tunnel creation method and number of assistants were important in ACL reconstruction done by HV surgeons.

• Experience of assistants was essential to reduce a surgical time in ACL reconstruction done by NHV surgeons, compared to other parameters.