Key Spino-Pelvic Parameters Affecting to Sagittal Balance in Postoperative Adult Spinal Deformity Patients with Minimum Two-Years Follow-Up

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Sagittal spinal malalignment is commonly defined by increased SVA

Glassman SD, et al. Spine 2005

SVA<50mm has been met with better HRQOL score

Schwab F, et al. Spine 2010

Key factor leading to SVA<50 in postoperative adult spinal deformity patient is not clear.
Purpose

To clarify key spino-pelvic radiographic parameters affecting to global sagittal balance in the postoperative adult spinal deformity (ASD) patients with minimum two-years follow-up.
Methods

- Adult spinal deformity: 55 pts
  - Age: mean 61 (38~81) yrs
  - Gender: Female: 41 pts, Male: 14 pts

- Pre & follow up full-length standing sagittal radiographs

- Spinal parameters
  - Thoracic kyphosis (TK), Thoracolumbar kyphosis (TL)
  - Lumbar lordosis (LL)

- Pelvic parameters
  - Pelvic tilt (PT), Sacral slope (SS), Pelvic incidence (PI)

- Sagittal vertical axis (SVA)

- PI/LL mismatch (PI-LL)
Stepwise multiple regression analysis was used to identify significant parameters associated with SVA.
Results

Follow up periods  44.3 (24~75) m

TK

TL

LL

PT

PI

°

TK

TL

LL

PT

PI

Follow up periods  44.3 (24~75) m

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TL

LL

PT

PI

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PT

PI

Follow up periods  44.3 (24~75) m

TK

TL

LL

PT

PI
Results

Preop: 43°
Postop: 9.9°
Final: 13.5°
Results

<table>
<thead>
<tr>
<th>SVA</th>
<th>Preop</th>
<th>Postop</th>
<th>Final</th>
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<tbody>
<tr>
<td>mm</td>
<td>99.7</td>
<td>28.7</td>
<td>43.7</td>
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0 20 40 60 80 100 120

mm
## Results — Multiple regression analysis —

<table>
<thead>
<tr>
<th>Parameters</th>
<th>P value</th>
<th>Regression Coefficient</th>
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<tbody>
<tr>
<td>TK</td>
<td>0.0001</td>
<td>1.2547</td>
</tr>
<tr>
<td>TL</td>
<td>0.72</td>
<td>0</td>
</tr>
<tr>
<td>LL</td>
<td>0.9</td>
<td>0</td>
</tr>
<tr>
<td>PT</td>
<td>0.14</td>
<td>0</td>
</tr>
<tr>
<td>PI-LL</td>
<td>&lt; 0.0001</td>
<td>2.5084</td>
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\[
SVA = 1.3TK + 2.5(\text{PI-LL}) - 26.4
\]

\[
R^2 = 0.5554
\]
PI-LL was associated factor to SVA, and this implicate that enough LL which reflect PI is necessary to obtain stable sagittal balance.

TK was associated factor to SVA in final follow-up. This may implicate the participation of proximal junctional kyphosis (PJK). Most of UIV in this series were lower thoracic. The UIV level in upper thoracic spine should be considered at high risk patients of PJK.
Authors Disclosure Information

Presenter: Satoshi Inami  No Relationships

Co-Authors:

<table>
<thead>
<tr>
<th>Name</th>
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Results

\[ SVA = 1.3TK + 2.5(PI-LL) - 26.4 \]

\[ R^2 = 0.5554 \]
66y. F.

Preop

17°
-8°

PT=29°
PI=45°

24°

SVA=116mm

Preop

41°

PT=14°
PI=45°

Postop 30m

SVA=18mm
予測式へのあてはめ

\[ SVA = 1.3TK + 2.5(PI-LL) - 26.4 \]
\[ = 1.3 \times 24 + 2.5 \times (45-41) - 26.4 \]
\[ = 14.8 \]
考察

SVAと脊柱骨盤パラメータの関係

・ 術直後：SVA≧50と<50の2群間で、PI-LLのみ有意差あり

2013, 自験例 本学会

・ 術後2年以上：PI-LLとTKが有意に関与

・ TKがSVAに関与する理由
  ✓ Proximal junctional kyphosis (PJK)
  ✓ Reciprocal Change (RC) in the TK

Lafage. Spine 2012
考察

• PJK
  ✓ 発生率：33% （種市. JSR 2013）
  ✓ QOLへの影響は少ない。
  ✓ 危険因子：高齢者、術前のTKおよびSVAが大きい

• Reciprocal Change  (Lafage. Spine 2012)
  ✓ T10以下のPSF 34症例
  ✓ 18症例は、術後SVA不良かつTKが増加
    （代償作用が働いていない）
  ✓ 危険因子：高齢者、PI/LL mismatch

高齢者、胸椎後彎が大きい, PI/LL mismatchな症例では、
術後経過でのTK増加に注意が必要
考察

- 注意すべきTKの大きさとは？

PI-LL=10として、SVA>50となるTKの値を予測式から求める

\[
SVA = 1.3TK + 2.5(PI-LL) - 26.4
\]

\[
50 < 1.3TK + 2.5 \times 10 - 26.4
\]

\[
39 < TK
\]

高齢者で胸椎後弯が40°以上ある症例