Mini-open anterior lumbar interbody fusion for degenerative spondylolisthesis.

National Okayama Medical Center
Dept. of Orthopaedic Surgery

K. TAKEUCHI, S. NAKAHARA, M. TAKAHASHI and S. ARATAKI
53 yrs. F  follow-up : 8.5 yrs.

Ant. & Post.  
Time : 206mins 
Bleeding : 251ml
25 yrs. F  follow-up : 2.0 yrs.

pre-Op.

Ant.
Time : 132mins
Bleeding : 111ml


follow-up
Study design

Retrospective review

mini-ALIF from 1999: mini-open anterior lumbar interbody fusion

   Ant. & Post. procedure
   mini-ALIF + PLF (PS)

2nd. Stage (2003 –):
   Ant. Procedure
   mini-ALIF
**Materials**

mini-ALIF (1999～)
Follow up : A minimum 2-year
85 cases ( M: 35, F: 50 ) / 100 levels

1 level : 71 cases ( L3/4 : 6, L4/5 : 58, L5/S : 7 )
2 levels : 13 cases ( L2/3/4 : 1, L3/4/5 : 11, L4/5/S : 1 )
3 levels : 1 cases ( L2/3/4/5 )
Age : ave. 55.9 yrs. ( 23-77 )
Follow up : ave. 4.0 yrs. ( 2.0-10.4 )

1st. Stage ( mini-ALIF + PLF ) : 62 cases / 76 levels
Age : ave. 60.1 yrs. Follow up : ave. 4.6 yrs.

2nd. Stage ( mini-ALIF, 2003～ ) : 23 cases / 24 levels
Age : ave. 54.4 yrs. Follow up : ave. 2.7 yrs.
**Methods**

**Clinical survey**
- JOA score
- LBP grade

**Image analysis**
- (Static change)
  - OA change
  - Alignment
  - Correction loss
  - Disc angle, height
- (Dynamic factor)
  - Increased disc motion
    - hypermobility
    - angular instability
    - vertical laxity
  - Instability
    - spondylolisthesis
**Results**

<table>
<thead>
<tr>
<th></th>
<th>pre-Op.</th>
<th>post-Op.</th>
<th>1 year</th>
<th>follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td>14.0</td>
<td>22.3</td>
<td>24.2</td>
<td>23.9</td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td>15.9</td>
<td>22.7</td>
<td>25.9</td>
<td>24.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JOA score ≥ 20</th>
<th>Group 1 / 62cases</th>
<th>Group 2 / 23cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>post-Op.</td>
<td>49</td>
<td>21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JOA score &lt; 20</th>
<th>Group 1 / 62cases</th>
<th>Group 2 / 23cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>post-Op.</td>
<td>13 (LBP(+) : 4)</td>
<td>2 (LBP(+) : 1)</td>
</tr>
</tbody>
</table>
Total:
Group 1: 62 cases / 76 levels
Group 2: 23 cases / 24 levels

Results

- Total:
  - Disc angle
    - pre-Op.
    - follow-up

- Disc height

- 0 degree:
  - Group 1: 23 levels
  - Group 2: 5 levels

- 7mm:
  - Group 1: 33 levels
  - Group 2: 8 levels
<table>
<thead>
<tr>
<th></th>
<th>mini-ALIF + PS</th>
<th>mini-ALIF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cranial</td>
<td>caudal</td>
</tr>
<tr>
<td>Disc narrowing</td>
<td>6.6</td>
<td>14.5</td>
</tr>
<tr>
<td>Endplate change</td>
<td>1.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Angular instability</td>
<td>21.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Instability</td>
<td>3.2</td>
<td>0</td>
</tr>
<tr>
<td>Bone union</td>
<td>60/62 (96.8%)</td>
<td>22/23 (95.7%)</td>
</tr>
</tbody>
</table>
Discussion

Strategy for Degenerative Lumbar Spondylolisthesis

Op.indication

Laminectomy

instability (−)

Spinal Fusion

Symptom at resting (−)

ALIF

Symptom at resting (+)

Posterior Spinal Fusion

Symptom at resting (+)

PLF

Slip angle (-)

PLIF

Slip angle (+)
mini-ALIF

Degenerative spondylolisthesis patients

with severe instability
low back pain due to instability

without rest pain
severe radiculopathy
severe urinary dysfunction
complete block in myelography

We have performed mini-ALIF
with a laparoscope.
Minimal invasive surgery

Post. Fusion

Approach: Weltz approach, TLIF, ...
Decompression: Endoscopic-, Microscopic-, ...
Instrument: Pedicle screw, Single rod, Cage, ...

Ant. Fusion

ALIF
↓
mini-ALIF + Post. Fusion
↓
mini-ALIF
71 yrs. F  
follow-up : 6.5yrs.

Ant. & Post.  
Time : 225mins  
Bleeding : 200ml
50 yrs. F
follow-up : 2.7 yrs.
Ant.
Time : 110mins
Bleeding : 50ml
**Summary**

**Operation**

- mini-ALIF + PS > mini-ALIF
- Op. time: 209.4 mins > 136.3 mins
- Bleeding: 251.6 ml > 150.4 ml

**Clinical survey**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>14.0</td>
<td>22.3</td>
<td>24.2</td>
<td>23.9</td>
</tr>
<tr>
<td>Group 2</td>
<td>15.9</td>
<td>22.7</td>
<td>25.9</td>
<td>24.4</td>
</tr>
</tbody>
</table>

**post – Op.**

- JOA score ≥ 20: 21 / 23 cases
- < 20: 2 / 23 cases

**Advantages:**

- minimal invasion
- no operation in spinal canal
- few complications
### Adjacent Lesions

**Background**
Degenerative changes

**Increased disc motion**
Hypermobility
Angular instability
Vertical laxity

**Instability**
Endplate change
Osteophyte

**Operation**

<table>
<thead>
<tr>
<th>Disc narrowing</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
</tr>
</thead>
<tbody>
<tr>
<td>mini-ALIF ( &gt; 2 yrs.)</td>
<td>0</td>
<td>8.7</td>
<td>6.3</td>
<td>12.5</td>
<td>23.1</td>
<td>11.5</td>
</tr>
<tr>
<td>mini-ALIF + PS ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLIF ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Angular instability</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
</tr>
</thead>
<tbody>
<tr>
<td>mini-ALIF ( &gt; 2 yrs.)</td>
<td>39.1</td>
<td>13.0</td>
<td>37.5</td>
<td>6.3</td>
<td>11.5</td>
<td>5.0</td>
</tr>
<tr>
<td>mini-ALIF + PS ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLIF ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instability</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
<th>cranial</th>
<th>caudal</th>
</tr>
</thead>
<tbody>
<tr>
<td>mini-ALIF ( &gt; 2 yrs.)</td>
<td>0</td>
<td>0</td>
<td>6.3</td>
<td>0</td>
<td>7.7</td>
<td>5.0</td>
</tr>
<tr>
<td>mini-ALIF + PS ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLIF ( &gt; 5 yrs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(%)
Conclusion

We have performed minimally invasive anterior lumbar interbody fusion (mini-ALIF) for lumbar instability.

In this study, we present a retrospective clinical and image analysis of mini-ALIF.

The data showed that this anterior procedure had an acceptable outcome.

1. Most patients were free from back pain and returned to their daily life after the surgery.
2. The consolidation of graft bone was observed by CT survey and all case achieved bony fusion in spite of slightly correction loss during follow-up.
3. The mini-ALIF is a safe and effective procedure to preserve posterior elements.