L5-S1 Isthmic Spondylolisthesis

42 yo male, 5 yr history of progressive in pain
CC- Low Back Pain made worse with mechanical activities (bending and lifting)
Left leg pain radiating from buttock to foot, numbness lateral Left calf
Rx- physical therapy, medication and epidural steroid injection
PE- Motor 5/5, sens. Decreased left lateral calf, DTRs 2+, SLR- Neg.

Castellvi Spine 2016
MIS L5-S1 TLIF

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Disclosures

• Stryker Spine
• Exactech
• Camber Spine
• Amendia
• Corelink
Minimally Invasive TLIF

**Advantages**
- Decreased soft tissue injury
- Unilateral exposure & less muscle dissection
- Preservation of contralateral structure
- Decreased operative bleeding

**Disadvantages**
- Technically demanding
- Increased operative time

Steep Learning Curve

Shin, et al. - Prospective analysis of:
Their first 41 cases of the MIS TLIF procedure
Degenerative lumbar disease treated by:
- Decompression through a tubular retractor
- Obliquely inserted a PEEK cage
- Percutaneous pedicle screw fixation and fusion
- F/U > Minimum of one year

Materials

**Patients characteristics**
- Average age: 57 yrs. (36-76)
- Average F/U: 21 m

**Etiology**
- Spinal stenosis: 24 cases
- Spondylolisthesis: 12 cases
- HIVD: 3 cases
- IDD: 1 case
- Segmental instability: 1 case

Procedure (41 patients)

- No. of operated levels
  - 1 level TLIF: 31 cases
  - 1 level TLIF + 1 level decompression: 8 cases
  - 2 level TLIF: 2 cases

- Laminectomy
  - Unilateral: 37 cases
  - Bilateral: 4 cases

- Contralateral decompression: 16 cases

Materials

- Assessing parameters of learning curve
  - Length of operative time
  - Amount of bleeding
    - Intra-operative bleeding
    - H-vac drain
    - Total peri-operative bleeding
  - Starting day of ambulation
  - Transfusion incidence
  - Occurrence of complications

- Clinical outcome
  - Oswestry disability index
  - Visual analogue scale
    - Low back pain
    - Radiating pain to legs

Methods

- Assessing parameters of learning curve

Statistical Analysis

- Regression analysis for learning curve
  - Bivariate analysis
    - Case # vs. parameters (operative time, bleeding)
    - Logarithmic curve-fit

- Former 20 vs. Latter 21 cases
  - Student T-test
    - Operative time, Blood loss, Start of ambulation
  - Chi-square test
    - Transfusion need, Occurrence of complications

- SPSS (ver.13.0)
  - p<0.05
Results

- **Start of ambulation**

![Graph showing start of ambulation with case numbers and standard deviations](image)

- **Occurrence of Complications**

![Bar chart showing occurrence of complications with case numbers and events](image)

- **Oswestry Disability Index**

![Graph showing Oswestry Disability Index with time points](image)
Results

VAS for Low Back Pain

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
<th>6W</th>
<th>3M</th>
<th>6M</th>
<th>1Y</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP</td>
<td>5.1</td>
<td>2.2</td>
<td>2.3</td>
<td>2.3</td>
<td>2.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Results

VAS for Radiating Pain to Legs

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
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<th>3M</th>
<th>6M</th>
<th>1Y</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP</td>
<td>6.9</td>
<td>0.7</td>
<td>1.0</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
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</tbody>
</table>

Results

Case #1-20 versus Case #21-41

* P<0.05
Learning curve for minimally invasive TLIF was steep, but acceptable. Asymptote of the curve was approximately 35-40 cases.

Operative time was significantly decreased with a surgeon’s experience.

<table>
<thead>
<tr>
<th>Mean Operative time</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Case #1-20</td>
<td>249 min</td>
</tr>
<tr>
<td>Case #21-41</td>
<td>198 min</td>
</tr>
</tbody>
</table>

Amount of bleeding and needs for transfusion also significantly decreased with a learning curve.

<table>
<thead>
<tr>
<th>Intraop.Bleeding</th>
<th>Perioperative Bleeding</th>
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</thead>
<tbody>
<tr>
<td>Case #1-20</td>
<td>506 ml</td>
</tr>
<tr>
<td>Case #21-41</td>
<td>272 ml</td>
</tr>
</tbody>
</table>

Minimally invasive TLIF can be an effective method treating degenerative lumbar diseases.

TLIF- Advantages

- TLIF obviates the morbidity from the retroperitoneal dissection and subsequent posterior fixation required for anterior lumbar interbody fusion (ALIF).
- Unlike PLIF, TLIF requires minimal to no retraction on the thecal sac and nerve roots while still providing 360 degrees of support.
- Because TLIF utilizes a more lateral trajectory, it can be performed in the setting of previous surgery with identifiable landmarks and a cleaner plane of dissection.
- The average length of stay for both minimally invasive and open TLIF ranged between 3 and 6 days.
Lumbar – Transforaminal Lumbar Interbody Fusion (TLIF)

Decompression
Removing the facet joint and disc relieves pressure on the compressed spinal nerve, allowing it to return to the proper position.

Fusion for DDD
Posterolateral fusion
Patients with some level of residual discogenic pain due to micromotion

Fusion for DDD
Interbody techniques
Remove pain generator
Large surface area for fusion where majority of spinal load bearing occurs
90% of the surface area
80% of the load
Compressive force through graft
Correction coronal and sagittal alignment
Anterior Approaches - Contraindications

ALIF
Contraindications
- Calcified aorta
- Prior vascular reconstructive surgery
- Prior intra-abdominal or retroperitoneal surgery
- History of severe pelvic inflammatory disease
- Prior anterior spinal surgery

Transpsoas
Contraindications
- At L5/S1 and sometimes at L4/5 because of obstruction from iliac crest
- Prior retroperitoneal surgery or scarring

ALIF - Complications

Retrograde ejaculation
- Most series < 1% to 7%
- Much higher with transperitoneal approaches and with laparoscopic approaches
- Blunt dissection versus electrocautery
- Large majority of patients recover within 6 - 12 months

Bowel Injury
Ureter Injury

ALIF - Complications

Rates variable - highly surgeon dependent

- Vascular complications of exposure for anterior lumbar interbody fusion.
- 212 ALIF exposures
- 2% rate of "serious" vascular complication
  1 arterial injury required thrombectomy and stent
  4 venous injuries required multi-suture repair
- No mortalities
Conclusions

• MIS TLIF is an effective method for treating degenerative lumbar diseases.
• It provides an adequate surface area for fusion where majority of spinal load bearing occurs.
• It can also provide correction of coronal and sagittal alignment.
• No access surgeon is necessary.
• The rate of “serious” vascular complications does not approach that of the ALIF procedure.