Minimally Invasive Direct Thoracic Interbody Fusion (MIS-DTIF): Technical Notes from a Single Surgeon Study
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Introduction
Problems with current Thoracic Fusions
- Lateral Approach: Thoracotomy with Rib removal
- Posterior Approach: Facetectomy and removal of head of rib
- Video-assisted Thoracoscopic surgery is difficult to master
- Pulmonary complications: Hemothorax, Pneumothorax

Solution: Minimally Invasive Direct Thoracic Interbody Fusion (MIS-DTIF)
- Truly MI: No Direct Visualization
- Approach without collapsing lung and without bone resection
- Complemented with MIS pedicle screw fixation
- This study: Proof of concept, Establish Safety and Efficacy

Methods
<table>
<thead>
<tr>
<th>ID</th>
<th>Sex</th>
<th>Age</th>
<th>BMI</th>
<th>Levels</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>37</td>
<td>32</td>
<td>T5-6</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>57</td>
<td>28</td>
<td>T8-9</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>57</td>
<td>34</td>
<td>T8-9 &amp; T9-10</td>
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<tr>
<td>4</td>
<td>F</td>
<td>36</td>
<td>37</td>
<td>T9-10 &amp; T11-12</td>
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</tbody>
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- All patients underwent full course of conservative therapy
- Indications: Degenerative disk disease, disk herniation, stenosis
- Exclusion: Scoliosis, hyperkyphosis, scapula blocks approach
- Recorded surgery time, blood loss, hospital stay, fluoroscopy time
- Chest X-Ray and CT post surgery in all patients
- 1 year follow up including pain score

Surgical Technique
1. Approach aided by A/P and Lat Fluoro + Electrophysiology
   • Enter a 8mm blunt canulated probe through an incision on posterior axillary line.
   • Walk probe along the rib inside the pleural space and position on disk of interest
   • Insert K-wire into disk space and working tube
   • Create sealed access to disk space
2. Discectomy performed through working tube
   • Remove disk material with drill, rotating curette, ring curette, rongeur
   • Prepare endplates by dilating rotating curette
   • Pack disk space with TriCalcium Phosphate soaked in autologous bone marrow aspirate
3. Cage entry
   • Insert cage over K-wire under biplanar Fluoroscopic monitoring
   • Enter space into disk space
   • Remove insertion devices, suture pleural space
4. Perform MI Posterior Pedicle Screw Fixation

Results and Discussion
<table>
<thead>
<tr>
<th>Perioperative Results</th>
<th>Mean</th>
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<tbody>
<tr>
<td>Blood loss (ml)</td>
<td>59</td>
</tr>
<tr>
<td>Surgery time (min)</td>
<td>61.4</td>
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<tr>
<td>Fluoroscopic time (s)</td>
<td>186.2</td>
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<td>Days to discharge</td>
<td>2.8</td>
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Clinical Results

<table>
<thead>
<tr>
<th>10 point pain</th>
<th>Oswestry disability</th>
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<tbody>
<tr>
<td>Pre op</td>
<td>8.8</td>
</tr>
<tr>
<td>Post op</td>
<td>3.5</td>
</tr>
<tr>
<td>1 year</td>
<td>5.3</td>
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</tbody>
</table>

Complications
- One patient: clinically insignificant hemothorax measuring 1cm, otherwise no hemothorax, pleural effusion, and pneumothorax as confirmed by CT

Discussion
- MIS-DTIF is the first MIS, thoracic fusion that does not require direct visualization, collapsing a lung, or facetectomy
- Disk space is sealed by access portal and can be freely packed with TCP/biologic
- Study expansion: MIS-DTIF in higher levels, MIS-DTIF for deformities, collecting fusion rates and long term follow-up

Conclusion: MIS-DTIF is a safe and effective minimally invasive fusion of the lumbar spine that warrants further study