Avoiding Damage to the Popliteal Neurovascular Bundle in All-Inside Suturing of the Posterior Horn of the Lateral Meniscus: An MRI Assessment of Portal Selection and Safety

Presented by Ron Gilat, MD

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Disclosure

- I (and my co-authors) have nothing to disclose
Background

• Arthroscopic meniscal repair is one of the most common orthopedic procedures.

• All-Inside suturing of the posterior horn of the lateral meniscus (PHLM) carries a risk for a rare, however, possibly devastating injury to the popliteal neurovascular bundle (NVB).

• Complications include massive bleeding, pseudoaneurysm and fistula formation, and may consequently result in revision surgery, and amputation.
• The purpose of this study is to assess the risk of damage to the popliteal neurovascular bundle (NVB) with all-inside suturing the posterior horn of the lateral meniscus (PHLM)

• We use axial cross-section magnetic resonance imaging (MRI) of the knee to simulate the trajectory of the all-inside suturing device when attempting to suture the PHLM
Methods

• We simulated all-inside suturing of the PHLM using axial plane cross-section MRI of 60 knees

• Lines were drawn from conventional anteromedial and anterolateral portals to the PHLM at increasing distance from the posterior cruciate ligament (0mm, 3mm, 6mm, 9mm, and 12mm), to simulate all-inside suturing device trajectory

• Distance from each of these lines to the PNVB was measured

• A similar analysis was performed for portals 1cm-medial and 1cm-lateral to the conventional portals
Distance Between the PHLM and the popliteal NVB

Young female patient

Older male patient

Red – popliteal artery; Blue – popliteal vein; Yellow – tibial nerve;
d – distance between the PHLM and the popliteal NVB
Simulation of All-Inside Suture Device

Trajectories at different Distances From PCL

Anteromedial Portal

Anterolateral Portal

Red – popliteal artery; Blue – popliteal vein; Yellow – tibial nerve; Green Line – signifies clear shot; Red line – signifies NVB transection; d – distance between simulated trajectory and popliteal NVB
Simulation of All-Inside Suture Device

Trajectories at different Distances From PCL

1cm-Medial Portal

1cm-Lateral Portal

Red – popliteal artery; Blue – popliteal vein; Yellow – tibial nerve; Green Line – signifies clear shot; Red line – signifies NVB transection; d – distance between simulated trajectory and popliteal NVB
## Results

### Demographic Characteristics of the Study Participants

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Number of Patients</strong></td>
<td>60</td>
</tr>
<tr>
<td><strong>Age Mean (range)</strong></td>
<td>44 (18-79)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20 (33%)</td>
</tr>
<tr>
<td>Male</td>
<td>40 (67%)</td>
</tr>
<tr>
<td><strong>Laterality</strong></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>30 (50%)</td>
</tr>
<tr>
<td>Left</td>
<td>30 (50%)</td>
</tr>
<tr>
<td><strong>Knee Cross-Section Area</strong></td>
<td></td>
</tr>
<tr>
<td>Mean (range) in mm$^2$</td>
<td>11,369 (8,451-16,336)</td>
</tr>
<tr>
<td><strong>Distance from PHLM to popliteal NVB</strong></td>
<td></td>
</tr>
<tr>
<td>Mean (range) in mm</td>
<td>7.8 (1.5-13)</td>
</tr>
</tbody>
</table>

*As measured by axial cross section magnetic resonance imaging of the knee. PHLM, posterior horn of lateral meniscus; NVB, neurovascular bundle.
Results

Average distances of simulated trajectories to the popliteal neurovascular bundle, stratified by different portals and increasing distances from the PCL

<table>
<thead>
<tr>
<th>Distance of Simulated Trajectory to PCL</th>
<th>1cm-Medial Portal</th>
<th>Medial Portal</th>
<th>Lateral Portal</th>
<th>1cm-Lateral Portal</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mm</td>
<td>1.4</td>
<td>0.5</td>
<td>1.6</td>
<td>2.7</td>
<td>&lt;0.001</td>
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<tr>
<td>3 mm</td>
<td>3.8</td>
<td>1.9</td>
<td>0.3</td>
<td>0.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6 mm</td>
<td>6.9</td>
<td>4.7</td>
<td>0.4</td>
<td>0.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>9 mm</td>
<td>10.1</td>
<td>8.2</td>
<td>1.7</td>
<td>1.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>12 mm</td>
<td>13.5</td>
<td>11.8</td>
<td>4.7</td>
<td>3.6</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

PCL, posterior cruciate ligament;
Conclusions

• Young and female patients have shorter distance between the PHLM and the PNVB

• All-inside suturing of the PHLM at 0mm from the PCL is safer using a more lateral portal. Beyond 3mm from the PCL a more medial portal is the safer option

• Preoperative MRI assessment may assist in safer portal selection when planning repair of the PHLM
Thank You

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References