A Novel Piriformis Injection Technique Utilizing Combined Fluoroscopy and Ultrasound – A Pilot Study

Sean Hua1, Briana Martiszus1, Sandy Christiansen1, Katrina Ramsey1, Emmanuel Zusmer1
1Department of Anesthesiology and Perioperative Medicine, Oregon Health and Science University

Introduction

- Piriformis syndrome is a constellation of symptoms characterized by deep gluteal pain, tenderness over the sciatic notch, irritation of the sciatic nerve and pain with hyperflexion of the piriformis muscle.
- One treatment for piriformis syndrome is the injection of local anesthetic, steroid, or botulinum toxin into the piriformis muscle.
- Various approaches for needle navigation into the piriformis muscle have been described, most commonly fluoroscopy or ultrasound.

Ultrasound:

- Ultrasound lacks real-time visualization of neurovascular structures while ultrasound has inferior identification of the bony landmarks.
- The hypothesis is that this technique provides an added safety margin while ultrasound has inferior identification of the bony landmarks.

Fluoroscopy lacks real-time visualization of neurovascular structures and has been described, most commonly fluoroscopy or ultrasound.

Various approaches for needle navigation into the piriformis muscle include anesthetic, steroid, or botulinum toxin into the piriformis muscle.

One treatment for piriformis syndrome is the injection of local anesthetic, steroid, or botulinum toxin into the piriformis muscle.

Deep gluteal pain, tenderness over the sciatic notch, irritation of the sciatic nerve are expected anatomical distribution.

Figure 1: Ultrasound guided needle navigation into the piriformis muscle.

Ultrasound & Fluoroscopy

- By combining the two modalities, inherent deficiencies of either technique are addressed.

Figure 2: Ultrasound guided needle navigation into the piriformis muscle.

Methods

Design: Retrospective cohort study examining outcome differences between needle guided imaging techniques used during piriformis injections.

Primary Outcomes: Pre- and post- piriformis injection pain scores.

Secondary Outcomes: Adverse events and procedure duration.

Statistics: Pain scores modeled longitudinally using robust variance estimates. The nonparametric Traub-Clark test was used for procedure duration.

Table 1: Pain scores before and after procedure by modality

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>Pre-procedure pain score</th>
<th>Post-procedure pain score</th>
<th>Mean difference</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound &amp; Fluoroscopy</td>
<td>10 (5.2)</td>
<td>10 (5.2)</td>
<td>0 (5.2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>11 (5.1)</td>
<td>10 (5.1)</td>
<td>1 (5.1, 5.2)</td>
<td>0.039</td>
<td></td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>12 (5.8)</td>
<td>12 (5.8)</td>
<td>0 (5.8, 5.8)</td>
<td>0.39</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Injection (Cases) of piriformis by imaging modality

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>N</th>
<th>Mean duration</th>
<th>SD</th>
<th>Median duration (25th, 75th percentile)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound &amp; Fluoroscopy</td>
<td>30</td>
<td>11.1</td>
<td>(8.3)</td>
<td>11 (9, 13)</td>
<td>-</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>18</td>
<td>11.4</td>
<td>(5.7)</td>
<td>10 (7, 13)</td>
<td>-</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>12</td>
<td>9.8</td>
<td>(5.8)</td>
<td>7.3 (5, 10)</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 4: Primary and secondary outcomes between needle guidance imaging techniques used.

Figure 5: Pre- and post- procedure pain scores compared between each imaging modality group. Change estimates modeled longitudinally with n = 100 procedures, 78 procedures.

Discussion

Takeways:

- All three imaging modalities had clinically significant reductions in pain scores by at least 3 points.
- The combined approach had the lowest mean post-procedure pain score of 1.3 (ISO 1.7) and the greatest reduction in pain with a score difference of 3.9 (ISO 2.2) (Table 1, Figure 4a, Figure 5).
- Statistically significant differences were found when compared to ultrasound guidance, -3.0 (ISO 2.1), (p = 0.029), but not when compared to fluoroscopy.3.0 (ISO 2.2), (p = 0.296).
- In terms of procedural duration, fluoroscopy had the fastest time (9 min) followed by ultrasound (10min), then the combined approach (11 min), (p = 0.013) (Table 2, Figure 4b).
- Although slower, the combined approach could be more efficient in obese patients, where thicker adipose layers may make obtaining needed ultrasound views more challenging.

Limitations:

- Retrospective study with limited sample size creates questions regarding generalizability of findings and the quality of data.
- Exclusion criteria did not exclude patients with low-procedure pain scores.
- One provider performed all but two of the fluoroscopy-only procedures, which could have influenced outcomes dependent on provider skill and experience.
- Timing of post-procedure pain score acquisition was not recorded. Pain scores may be obtained during local anesthetic action window.

Conclusion:

Piriformis injections using combined fluoroscopic and ultrasound guidance may result in greater accuracy into target muscle and better outcomes, further supporting the use of this novel approach.

References