Thermographic Imaging to Evaluate the Efficacy of Caudal Epidural Injection

Adam Stuart M.D., Neeraj Mehta M.D., Luis Sequera Ramos M.D., John Hajduk, Amod Sawardekar M.D., Narasimhan Jagannathan M.D.

Department of Pediatric Anesthesiology, Ann & Robert H. Lurie Children’s Hospital of Chicago; Chicago, Illinois

Introduction

- Caudal epidurals have been shown to be safe for peri-operative analgesia in the pediatric surgical patient.
- Present clinical practice dictates that determination of successful caudal epidural blockade is based on assessment of the subjective tactile sensation upon injection and changes in the patient’s vital signs.
- These evaluations are often subjective, and therefore prone to error and may not provide accurate feedback prior to surgical incision.
- Inadequate feedback may affect trainee acquisition of skills and confidence when performing this procedure.
- Neuraxial anesthesia results in blunting of the sympathetic nervous system and subsequently causes peripheral vasodilation and skin temperature change.
- An App with a thermographic camera was used to observe changes in skin temperature post-caudal.
- This investigation sought to determine if any thermographic changes are associated with a successful caudal block prior to surgical incision.

Methods

- This study was IRB approved.
- Ten patients younger than five years of age scheduled for surgery amenable to caudal blockade were enrolled.
- A FLIR One thermographic camera connected to an iPad was used to photograph images of patients’ lower extremities pre-caudal and post-caudal at one minute intervals out to 5 minutes.
- Operating room temperature was maintained between 68 and 72 °F and patients were not actively warmed.

Results

<table>
<thead>
<tr>
<th>Male (n)</th>
<th>Age (mos)</th>
<th>Weight (kg)</th>
<th>Height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>9.5 (7.15)</td>
<td>9 (8.6-10.8)</td>
<td>74 (71-80)</td>
</tr>
</tbody>
</table>

**Durations (min)**

<table>
<thead>
<tr>
<th>From GA Start to Baseline Image</th>
<th>From GA Start to Block Placement</th>
<th>From Baseline Image to First Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (4-6)</td>
<td>10.5 (8-12)</td>
<td>7 (6-8)</td>
</tr>
</tbody>
</table>

**Temperatures – Great Toe**

<table>
<thead>
<tr>
<th>Baseline Left</th>
<th>Baseline Right</th>
<th>1 Minute Post-Caudal Left</th>
<th>1 Minute Post-Caudal Right</th>
<th>5 Minute Post-Caudal Left</th>
<th>5 Minute Post-Caudal Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.2 (29-37.2)</td>
<td>34.4 (30.7-36.4)</td>
<td>38.3 (36.8-39)</td>
<td>37.9 (36.3-38.8)</td>
<td>37.7 (37.1-37.8)</td>
<td>38.1 (37.6-38.5)</td>
</tr>
</tbody>
</table>

**Temperatures - Anterior Dorsalis Pedis**

<table>
<thead>
<tr>
<th>Baseline Left</th>
<th>Baseline Right</th>
<th>1 Minute Post-Caudal Left</th>
<th>1 Minute Post-Caudal Right</th>
<th>5 Minute Post-Caudal Left</th>
<th>5 Minute Post-Caudal Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.4 (30.5 35.6)</td>
<td>33.6 (28.9 35.7)</td>
<td>37 (36.7 37.9)</td>
<td>38.2 (37.7 38.6)</td>
<td>37.6 (37.1 37.8)</td>
<td>37.5 (37.2 37.7)</td>
</tr>
</tbody>
</table>

**Time from Block to PACU Evaluation (min)**

108 (84-136)

Figure 3: Pre/Post Caudal Temperatures

Great Toe

Dorsalis Pedis

Figure 1: Pre-block assessment

Figure 2: Five minutes post-block

Conclusion/Discussion

- Our data demonstrates that successful caudal blockade can be predicted by a positive thermographic change in the lower extremity skin temperature after local anesthetic injection.
- The ability to discern the effectiveness of a caudal injection for patient analgesia has broad clinical significance.
- Using objective data to discern the presence or absence of blockade permits appropriate changes to the anesthetic and postoperative plan.
- Additionally, timely feedback to the trainee may permit a faster trajectory of improvement and caudal skill acquisition.

References


