Multi-modal pediatric pain management with continuous paravertebral block for minimally invasive pectus excavatum

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BACKGROUND
Optimal analgesia for patients undergoing thoracotomy or chest wall surgery continues to be a challenge. While epidural analgesia is considered the gold standard for pain control in this surgical population, side effects or complications such as hypotension, urinary retention, nausea, itching, and more seriously, epidural hematoma or neurologic injury can limit its utility. In the pediatric population these risks are possibly higher due to the placement of these catheters while under heavy sedation or general anesthesia or with an uncooperative patient. Therefore, as an alternative, we adopted a paravertebral catheter protocol that includes a multi-modal analgesia strategy minimizing the above mentioned side effects. Also, ultrasound guidance is used, theoretically increasing the safety of catheter placement under general anesthesia.

Paravertebral catheter placement data which has been reported in adult literature suggests that paravertebral blockade has excellent analgesic benefits with lower side effects.1

Limited evidence is available in a pediatric surgical population with regards to paravertebral blockade for postoperative analgesia. Reports are varied and include case reports of paravertebral catheters, single injections for renal surgery or hernia repair, catheters for major renal surgery2, and catheters for infants post-thoracotomy3.

The purpose of this study is to describe our experience with continuous paravertebral blockade in a series of pediatric patients age < 18 years undergoing Nuss procedure for pectus excavatum.

DISCUSSION
Paravertebral catheters with the multimodal pain protocol improved pain scores, early ambulation, early oral intake and early home discharge in children undergoing Nuss procedure.

Strength of PVB catheters:
- Reliably and safely placed under general anesthesia (with ultrasound guidance)
- Prolonged analgesia support, can discharge to home with disposable local anesthetic pump
- Potentially decrease narcotic side effects by reducing total opioid used
- Oral intake within 24 hours of surgery

Weakness of PVB catheters:
- Takes 10-20 minutes to place
- Challenging technique if use the ultrasound technique

Limitations of this report include:
- Not randomized to epidural or PCA alone
- Limited epidural cases
- Paravertebral catheters/multimodal were recent and pediatric pain service managed pain. Other analgesia strategies were not.

REFERENCES

Paravertebral Catheter & Multimodal therapy
- Hydromorphone PCA
- Day 1 → Oxycodone
- Ketorolac IV → Ibuprofen PO
- Acetaminophen (scheduled)
- Neurontin
- Scopolamine patch
- Paravertebral catheter infusions:
  - Lidocaine 1 % infusion
  - 0.02 mL/kg/hr + bolus every 4hr 0.04 mL/kg

<table>
<thead>
<tr>
<th>Problem:</th>
<th>Paravertebral C. (n =47)</th>
<th>Epidural (n =5)</th>
<th>Intercostal S. Shot (n= 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine equivalence</td>
<td>57 ±23</td>
<td>54 (41, 66)</td>
<td>90 ±41</td>
</tr>
<tr>
<td>Pain score (VAS–ave)</td>
<td>3.4 ±1.0</td>
<td>4.4 ±1.3</td>
<td>N/A</td>
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<tr>
<td>LOS</td>
<td>3.3 ±0.7</td>
<td>4 ±0.5</td>
<td>5.1 ±1.7</td>
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<tr>
<td>Nausea &amp; vomiting</td>
<td>+++</td>
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</tr>
<tr>
<td>Urinary retention</td>
<td>0</td>
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Paravertebral C. (n =47)
Epidural (n =5)
Intercostal S. Shot (n= 15)

Morphine equivalence
57 ±23
54 (41, 66)
90 ±41
80 (64,118)
107 ±48
83 (78, 129)

Pain score (VAS–ave)
3.4 ±1.0
4.4 ±1.3
N/A

LOS
3.3 ±0.7
4 ±0.5
5.1 ±1.7

Nausea & vomiting
++
+++ 
+++

Urinary retention
0 
+++ 
+

Pleural Needle
Pleura

Problem:
Solution:

Paravertebral Catheter & Multimodal therapy
- Hydromorphone PCA
- Day 1 → Oxycodone
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