Erector spinae plane block for pediatric hip surgery
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Running title: ESPB for pediatric hip surgery
Abstract

The surgical repair of the hip is considered an extremely painful procedure. Managing pain in this surgery is challenging with several options available, each with limitations. Erector spinae plane (ESP) block is a novel technique with promising results that have been reported in different types of surgery. Herein, we describe a case of successful ESP block for pediatric hip surgery which could be in the future an alternative technique for providing effective analgesia.

Keywords: ANALGESIA; CHILD; ERECTOR SPINAE PLANE BLOCK; HIP SURGERY.
The surgical repair of the hip can be extremely painful and is associated with significant postoperative pain despite the use of systemic opioids in children. These patients may benefit from neuraxial analgesia in adjunction with general anesthesia. The reported advantages include decreased patient opiate exposure, decreased postanesthesia recovery room time and hospital stay, and increased patient satisfaction. However, the significant rate of adverse effects caused by these techniques limits their use in children [1,2]. Of these adverse effects, hypotension, postoperative nausea and vomiting, urinary retention, excessive motor block and pruritus are the most observed. Regional anesthetic techniques would seem a better choice for improving acute pain management in these patients with less adverse effects. Herein, we describe our experience with the erector spinae plane (ESP) block, a novel technique of regional anesthesia which would provide effective analgesia for pediatric hip surgery.
CASE REPORT

Parental informed consent for publication was obtained. A 4-year-old female patient (15-kg), American Society of Anesthesiologists physical status I, was scheduled for surgical treatment of developmental dysplasia of the right hip under general anesthesia. She was monitored continuously with ECG, pulse oximetry, non-invasive blood pressure, and temperature. Following induction with propofol and vecuronium, a 4.5 mm orotracheal tube was easily inserted into the trachea. Controlled ventilation was administered with 50% oxygen in air and anesthesia was maintained using sevoflurane. An ultrasound ESP block was performed with the patient lying on her left side and the surgical side at the top. After skin disinfection, sterile draping was placed and ultrasound probe was sheathed. The level of the block was the transverse process of L2, using a 9-12 MHz linear probe (LOGIQe ®; GE Healthcare, Wauwatosa, WI, USA) and placed in a parasagittal plane 1 cm from the posterior midline. The deep plane to the erector spinae muscle (ESM) was identified and a 22 Gauge 50 mm insulated needle (Pajunk Sonoplex stim ®, Geisingen, Germany) was inserted craniocaudally in plane between the transverse process and the fascia of the ESM (fig.1). After negative aspiration, 0.3 mL.kg-1 of bupivacaine 0.25% was injected confirming correct position by visualizing the solution lifting the ESM off the transverse process (see supplementary video). Spread of LA between the L1 and L4 transverse processes was thereafter visually tracked with the transducer. The surgical incision was performed after twenty minutes and the surgery lasted two-and-a-half hours during which the hemodynamic state remained stable with excellent pain control under minimal anesthetic requirements. Changes in blood pressure and heart rate did not exceed 10% of the baseline (recorded at anesthetic induction). Intraoperatively, no systemic analgesics were needed apart from scheduled acetaminophen administered 30 minutes before the end of the surgery. The patient was extubated, and emergence from...
anesthesia was uneventful. She had a maximum FLACC scale of 1 in 24 hours with acetaminophen 15mg.kg\(^{-1}\) every 6 hours. The second day of surgery, a pain scale of 3 on the FLACC was noted which was controlled with nonsteroidal anti-inflammatory drugs and permitted to reduce the FLACC scale to 1 without further need for opioid analgesics.
DISCUSSION

First described by Forero [3], ESP block is a novel block where local anesthetic (LA) is deposited between the ESM and the underlying transverse process. It is a simple procedure technique compared to ultrasound-guided paravertebral block which is viewed as a technically challenging, time consuming, and carrying with it significant risks. Less technical expertise is required for the ESP block as the sonographic leading points are easily visualized. This method is also quite safe because the site of injection is far away from the pleura, neuraxial and major vascular structures. Furthermore, the craniocaudal spread of LA along the fascial plane underlying the ESM permits an extensive and thus multiple dermatomal coverage from a single injection site [3]. Local anesthetic also penetrates anteriorly through the intertransverse connective tissue gaining indirect access to the paravertebral space where it can potentially block the dorsal and ventral rami of spinal nerves [3]. It may also block sympathetic nerve fibers [4]. This block has been shown to be effective in providing thoracic analgesia when performed at the T5 level [5] and extensive somatic and visceral abdominal analgesia when performed at the T7-9 level [6].

The use of ESP block is limited to the thoracic localization in the pediatric population with only a few reports (table 1). It has been reported to provide effective postoperative analgesia for thoracic surgeries [7-11], nephrectomy [12], inguinal hernia repair [13] and laparoscopic cholecystectomy operations [14] in pediatric population. To our knowledge, ESP block performed in lumbar region has not been reported in children.

Tulgar et al. reported a successful ultrasound guided ESP block performed at L4 transverse process level for postoperative analgesia in adult patients undergoing hip and proximal femur surgeries [15]. CT imaging performed after the ESP Block showed contrast material spreading along the lumbar
plexus from T12 to S1 vertebra confirming the hypothesis that the local anesthetic would spread similar to ESP block performed in thoracic levels. Similarly, the present report suggests that lumbar ESP block performed at the L2 level could provide effective postoperative analgesia for pediatric hip surgery. Furthermore, it suggests that ultrasound guided ESP block could be the sole method for intraoperative analgesia and thus obviating opioid usage.

To date, there are no recommendations regarding the optimal dose of LA to use in ESPB in children. Some previous reports have used relatively smaller volumes of LA or were aligned with the volumes and concentrations reported in this case. Hernandez et al. used a volume of 0.2 mL/kg of bupivacaine 0.25% to perform an ESP block for inguinal hernia repair in a 2-month-old male. They also state that they have been able to achieve adequate spread and analgesia with a volume of 0.2 to 0.3 mL/kg in other pediatric patients undergoing thoracic surgery [13]. Kaplan et al. reported the successful use of a modest amount of LA with an approximate of 0.3 mL/kg bolus in an infant weighing 7 kg [11]. A future research regarding the optimal LA volume and concentration in ESPB in children would be useful to the future practitioner and to further enhance our understanding of this useful block.

ESP block performed at the L2 level as an adjunct to general anesthesia may be effective in providing reliable surgical analgesia and satisfied postoperative pain control for pediatric hip surgery. It could be a reasonable alternative for operators who are wary of other techniques due to their high potential for complications and/or requiring advanced skills especially in the pediatric population.
REFERENCES


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<th></th>
<th>Age</th>
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<tr>
<td>Muñoz et al. [7]</td>
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<td>Tumor of the 11th right rib</td>
<td>T8</td>
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<td>14 ml (weight NP)</td>
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<td>De la Cuadra-Fontaine et al. [8]</td>
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<td>Open thoracic surgery</td>
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<td>Hernandez et al. [9]</td>
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<td>Ueshima et al. [10]</td>
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<td>0.6 ml/kg into each side</td>
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<td></td>
<td>8 y</td>
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<td>Kaplan et al. [11]</td>
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<td>T6</td>
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<td>Aksu et al. [12]</td>
<td>7 y</td>
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<td>0.5 ml/kg</td>
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<td></td>
<td>6 m</td>
<td>Nepohrectomy</td>
<td>T12</td>
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<tr>
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<td>Present case</td>
<td>4 y</td>
<td>Developmental dysplasia of the hip</td>
<td>L2</td>
<td>Bupivacaine 0.25%</td>
<td>0.3 ml/kg</td>
<td>L1-L4</td>
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y=years; m=months; LA=Local anesthetic; NP=not precised
Figure Legends

Figure 1:

Ultrasound showing needle (marks) on top of transverse process of L2.