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Supraclavicular Brachial Plexus Block Guided by Ultrasonography in Pediatric Patient: A Case Report

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ABSTRACT

Background: Supraclavicular brachial plexus block has proven to be very useful in upper limb surgeries in pediatric patients. Supraclavicular brachial plexus block is preferred over general anesthesia for pediatric patients undergoing upper limb surgeries. This study aimed to report a procedure of supraclavicular brachial plexus block guided by ultrasonography in a pediatric patient undergoing orthopedic surgery on the upper extremity, which yielded good results, a high success rate, reduced opioid usage, and aided in faster recovery while minimizing complications. **Case presentation:** The patient was a 14-year-old child with a diagnosis of malunion in the left distal radius after open reduction internal fixation (ORIF) planned for osteoclast surgery and ORIF with regional anesthesia through supraclavicular brachial plexus block. The patient was monitored during the surgery, and after the surgery, the patient returned to the ward; the patient was given oral analgesics without opioids for pain management. **Conclusion:** The efficient regional anesthesia procedure option for upper limb surgeries in pediatric patients is the supraclavicular brachial plexus block. Due to lower risks and fewer side effects, the supraclavicular brachial plexus block procedure is preferred over general anesthesia in pediatric patients.

1. Introduction

Supraclavicular brachial plexus block in pediatrics has gained widespread acceptance worldwide over the past few decades. Several factors have contributed to the widespread use of regional anesthesia in pediatrics, one of which is the supraclavicular brachial plexus block.¹ The supraclavicular brachial plexus block was first used in the early 21st century and has become a preferred choice due to its high success rate. It offers the broadest sensory block among all brachial plexus block approaches and is efficient for upper limb surgeries. The supraclavicular brachial plexus block approach has become a safe and effective technique, commonly used in upper and lower limb surgeries in pediatric patients, including procedures on the hand, wrist, forearm, and elbow, which reduces the need for

general anesthesia in pediatric patients. This technique involves the administration of local anesthesia near the brachial plexus, providing excellent anesthesia effects and reducing post-operative pain.^{2,3}

The supraclavicular brachial plexus block technique guided by ultrasonography (USG) has been developed and integrated into regional anesthesia, providing a high success rate for supraclavicular brachial plexus block procedures.⁴ Currently, advancements in technology use USG as a guiding tool in pediatric regional anesthesia practice. It has yielded numerous benefits, including reduced opioid usage, decreased post-operative nausea and vomiting, minimized intraoperative and post-operative pain, and decreased post-operative respiratory complications.

Supraclavicular brachial plexus block is increasingly used as part of a multimodal analgesic regimen and has proven to be a good alternative for reducing post-operative opioid use and shortening hospital stays.^{1,2}

Due to its efficient pain reduction capabilities during upper limb surgeries, the supraclavicular brachial plexus block is highly important for pediatric patients. General anesthesia can often be minimized with this method, thereby reducing specific risks and decreasing opioid usage, which minimizes potential opioid-related side effects.⁵ This technique serves as a good pain management option for pediatric patients undergoing upper limb procedures, allowing for faster recovery and reducing surgery-related anxiety, and can be adapted for various age groups. Proper anesthesia administration provides significant benefits in the post-operative pain period, minimizing the risk of chronic pain. Therefore, regional anesthesia is considered one of the techniques that can be applied in pediatric upper limb surgeries.⁶ This study aimed to report a procedure of supraclavicular brachial plexus block guided by ultrasonography in pediatric patients.

2. Case Presentation

A 16-year-old male with a diagnosis of malunion in the left distal radius following open reduction internal fixation (ORIF) was planned for osteoclasis and ORIF surgery. On anamnesis, the patient complained of deformity in the right arm after the initial surgery, so the patient was planning for another surgery. Preoperative physical assessment revealed blood pressure of 120/70 mmHg, heart rate of 81 beats per minute, respiratory rate of 16 times per minute, oxygen saturation (SpO₂) of 98-99%, and a pain scale rating of 0/10. Laboratory results showed hemoglobin levels of 16.10 g/dL, hematocrit at 47.40%, and a platelet count of 262.00 x 10³/μL. A radiographic examination of the left wrist showed an incomplete fracture with bowing deformity of the left 1/3 distal radius, along with dislocation and soft tissue swelling. The patient was assessed with ASA I physical status and was planned for regional anesthesia using a peripheral nerve block (RA-PNB) with a

supraclavicular brachial plexus block. Preoperatively, the patient underwent fasting for solid food, milk, and drinking water. Premedication was administered with midazolam, ketamine, and dexamethasone. The patient was positioned supine, and intraoperative monitoring was established, including blood pressure, respiratory rate, pulse rate, electrocardiography (ECG), oxygen saturation, and oxygen delivery via a nasal cannula at 3 liters per minute. The supraclavicular brachial plexus block was performed on the right hand using a regimen of 0.5% bupivacaine and 2% lidocaine. Postoperatively, the patient received oral analgesics, which included 500 mg of paracetamol every 6 hours intraorally and 400 mg of ibuprofen every 8 hours intraorally.

3. Discussion

In pediatric patients undergoing surgery with a supraclavicular brachial plexus block, several factors need careful consideration. The supraclavicular brachial plexus block plays a crucial role in ensuring patient comfort during surgery, care, and recovery.⁷ The technique of supraclavicular brachial plexus block guided by ultrasonography has emerged as a valuable and increasingly preferred method in pediatric anesthesia management and pain control. This procedure is minimally invasive and precise, utilizing ultrasound imaging to visualize the administration of local anesthesia for the supraclavicular brachial plexus block, providing targeted pain management for pediatric upper limb surgeries.⁸ From preoperative preparation to intraoperative and postoperative care, pediatric patients should feel comfortable while undergoing surgery with supraclavicular brachial plexus block. In the preoperative phase, patients are given midazolam as an anxiolytic agent to provide a sense of calm. Additionally, sub-dose ketamine can be administered to provide analgesic benefits.

Performing a supraclavicular brachial plexus block procedure guided by ultrasonography is essential for achieving high success rates. Real-time ultrasound imaging is used to visualize the brachial plexus and anatomical structures clearly, reducing the risk of

accidental nerve or blood vessel damage. This is particularly crucial for pediatric patients to prevent potential long-term consequences. The ability to accurately place the needle is one of the primary advantages of ultrasound guidance in pediatric patients.⁹ This method provides precise anesthesia in clearly defined anatomical regions, making it highly advantageous for upper limb surgeries. It is favored by many medical professionals due to several key benefits for pediatric patients.¹⁰ In addition, the use of the supraclavicular brachial plexus block offers other advantages, such as reducing the need for general anesthesia in upper limb surgeries, minimizing post-operative nausea and vomiting, decreasing opioid usage, post-operative pain control, and reducing the length of hospital stay.^{8,11,12}

Pediatric patients are positioned supine with the head slightly turned away from the side where the block will be performed. This position is crucial for ensuring patient comfort and providing optimal support and access to the procedure.¹³ Identifying anatomical landmarks accurately is essential for precise needle placement. Ultrasonography offers real-time visualization of the brachial plexus and its proximity to surrounding structures, allowing for accurate needle placement and minimizing the risk of complications.^{13,14}

Prior to injecting local anesthesia, aspiration is performed to check for signs of intravascular placement, confirming the safety of the procedure. Local anesthesia is injected slowly and steadily with constant monitoring on the ultrasound screen to confirm proper spread and coverage of the targeted nerves. Successful block confirmation is assessed by observing the patient's response, such as numbness, tingling, or loss of sensation in the upper limb, indicating a successful block. Additionally, a decrease or loss of motor function in the limb can also serve as confirmation of a successful block. In this case, a local anesthesia solution of 0.25% bupivacaine and 2% lidocaine with a volume of 20 ml was slowly injected, resulting in a complete block in the patient.

Research by Govender et al. recommends 20 ml of 0.5% bupivacaine for surgical procedures, while 20 ml of 0.25% or 0.125% bupivacaine is recommended for analgesic blocks.² A study by Zahdrazil et al. on ultrasound-guided brachial plexus anesthesia in children showed an overall success rate of 94.9% and an overall block failure rate of 5.1%. Park et al.'s research demonstrated that ultrasound-guided supraclavicular brachial plexus block using 0.1 mL/kg of 0.5% ropivacaine significantly reduced post-operative pain scores in pediatric patients.¹⁵ These findings indicate that ultrasound guidance can effectively provide good results, rapid onset, reduce complications, achieve a high success rate, and minimize opioid usage for post-operative pain management.^{16,17}

Safety is of utmost importance, especially for younger patients. Additionally, ultrasound-guided supraclavicular brachial plexus block is recommended as a comfortable and highly effective anesthesia option for upper limb surgeries in pediatric patients.¹⁸⁻²⁰

4. Conclusion

The efficient regional anesthesia procedure option for upper limb surgeries in pediatric patients is the supraclavicular brachial plexus block. Due to lower risks and fewer side effects, the supraclavicular brachial plexus block procedure is preferred over general anesthesia in pediatric patients. It is considered safe, has a high success rate, low complications, reduced opioid usage, shortened hospital stays, and faster recovery. However, in pediatric patients, this procedure requires careful evaluation, precise dosage calculations, and monitoring during surgery.

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