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Ultrasound-Guided Infraclavicular Block for Closed Reduction Procedures on Pediatric Forearm Fractures: A Report of Ten Cases

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Abstract: Procedural sedoanalgesia is a frequently used method in the emergency departments during pediatric interventional procedures and reductions. However, the method has some disadvantages such as respiratory and cardiac depression. Following the usage of ultrasonography in emergency medicine practice, the upper extremity nerve blocks have particularly gained popularity. However, the use of these blocks for pediatric cases is limited. With this series of ten cases, we aimed to share our successful ultrasound-guided infraclavicular block experiences in patients who had undergone forearm fracture for closed reduction. © 2020 NTMS.

Keywords: Pediatric, Fracture, Infraclavicular Block, Ultrasound, Anesthesia, Regional, Emergency Departments.

1. Introduction

Pediatric upper extremity traumas are one of the most common causes for emergency admission, and forearm traumas constitute majority of those admissions (1). Closed reduction has become the preferred treatment method for forearm fractures in pediatric patients (2). Similar to all extremity fractures, severe pain is experienced during forearm fracture reduction. Pain control is essential for comfort of both patient and practitioner during painful procedures, such as forearm fracture reduction. In the emergency department (ED), procedural sedoanalgesia (PSA) is most commonly used for this purpose. In most of the sedative and analgesic drugs used for PSA, serious side effects such as hypotension, cardiac, and respiratory depression are observed.

Furthermore, patients who have undergone sedoanalgesia must return to their previous consciousness status to be discharged from the ED; this results in late discharge of patients from the ED, thus increasing the associated workload of orthopedist and other physicians.

The perioperative analgesia and ultrasound-guided (UG) nerve blocks, which are used in anesthesia, are being used in the ED (3). The literature has demonstrated the performance and efficacy of brachial plexus block that has been performed for shoulder and elbow dislocation and fracture reduction in adult patients (4).

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Pediatric ultrasound-guided infraclavicular brachial plexus block is frequently used in routine anesthesia practice for surgeries of hand and forearm. This block provides effective postoperative analgesia, and it is easy to use and safe. There are no case reports on brachial plexus block in the ED for children.
In this case series, we present UG infraclavicular block performance for closed reduction in ten patients with forearm fractures in the ED.

2. Material and Methods

2.1. Report of the cases

We decided to perform closed reduction under infraclavicular block in ten patients who were admitted to the ED with deformity and pain in the forearm due to falling down. Consent for publication has been obtained from closest relatives of patients. The ten patients were taken to the observation room and standard monitoring was performed (SpO_2, blood pressure, and electrocardiogram); subsequently, vascular access was entered and 0.09% NaCl was infused at the rate of 6 ml/kg/h.
The site to be intervened and the ultrasound probe were prepared in a sterile condition. When the patient was in a supine position, the head was reversed from the fractured side. The sterile USG probe was inserted into the lateral infraclavicular fossa, and the brachial plexus cords located around the axillary artery were monitored. After skin infiltration with local anesthetic, in-plane technique was used to enter the cranial to caudal direction. Between the posterior cord and the axillary artery, the probe was inserted at seven o'clock direction; no blood or air was detected by negative aspiration, and local anesthetic solution (0.5 ml/kg 1% lidocaine) was infused. After the blocks, sensory examination was performed within 20 minutes, and median, ulnar, and radial nerves were evaluated by hot and cold test. Sufficient anesthesia level was achieved, closed reduction was performed by orthopedic surgeon with traditional method. Wong Baker Scale (WBS) was used to evaluate pain before and after the procedure.
Data related to the case series block are shown in Table 1. For the ten patients (age, 10–14 years; WBS score, 6–10), WBS scores were recorded between 0 and 2 after UG infraclavicular block and during the reduction procedure. Block performance time ranged from 1 to 3 minutes. There were no complications or side effects during the procedures. It was observed that orthopedic practitioner and patient satisfaction were extremely good. The patients were discharged from the emergency department within 15–30 minutes after the forearm fracture reduction and after the control charts were constructed.

3. Discussion

In pediatric patients who undergo forearm fracture reduction at the ED, adequate analgesia levels are achieved with UG infraclavicular brachial plexus block. This helps avoid the potential risks associated with PSA.
Peripheral nerve blocks are frequently used by anesthesiologists for surgeries of upper extremity. Brachial plexus blocks of different levels, such as interscalene, supraclavicular, infraclavicular, and axillary blocks, have been defined for upper extremity procedures. It has been reported that infraclavicular block can be used in a shorter time and patient satisfaction is better in terms of pain.(5). Luftig J et al. demonstrated that the need for sedoanalgesia in the upper extremity procedures can be reduced by infraclavicular block in ED, and these blocks can be an alternative to PSA (6). In another case report of an adult patient, it was reported that infraclavicular block for wrist dislocation in the ED provided effective, rapid, and safe analgesia.(7) Many pediatric infraclavicular blocks have been reported to be used in anesthesia practice (8); however, in the monitoring of pediatric patients who undergo infraclavicular block, there were no reports on patients in the ED. In this case series, because pain was reduced after forearm fracture reduction, lidocaine -a short-acting local anesthetic- was used to prepare the analgesic solution for the block. The masking potential of infraclavicular block can delay the diagnosis of compartment syndrome particularly in pediatric population. We did not prefer using long-acting local anesthetic for early detection of complications after the reduction procedure. Therefore, we believe that lidocaine is a suitable drug in emergency procedures for rapid and early discharge of patients. In addition, all parents were informed about the compartment syndrome and discharged from the emergency room.
In this case series, the block was used to suitable and cooperative patients who aged 10 years and older.

Table 1: Demographic and procedural datas of cases. M:Male, F:Female, WBF: Wong Baker Faces Score , * Before Procedure, ** During and After Procedure.

	Age	*Sex*	*Weight*	*Fracture Localization*	*Block Performing Time (second)*	*WB** Score*	*WBF* Score*	*Duration of Analgesia (min)*	*Length of Stay ED (min)*
Case 1	10	M	40	Radius+Ulna	60	8	0	60	15
Case 2	13	F	55	Radius+Ulna	180	10	0	45	20
Case 3	10	F	35	Radius	75	8	0	75	30
Case 4	14	M	42	Radius+Ulna	90	6	0	90	30
Case 5	12	M	36	Radius+Ulna	125	8	2	70	25
Case 6	13	M	30	Radius+Ulna	150	10	0	80	30
Case 7	11	M	51	Radius+Ulna	160	7	0	90	30
Case 8	10	M	35	Radius+Ulna	120	9	2	120	30
Case 9	10	F	36	Radius	60	9	2	45	25
Case 10	14	M	44	Radius+Ulna	75	9	0	60	30

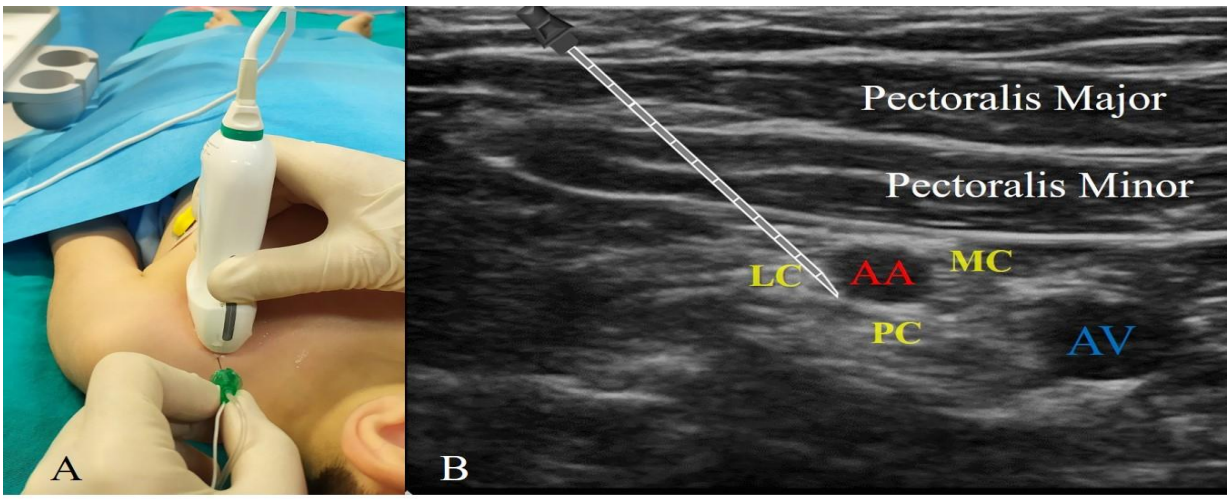

Figure 1. A) Patient and ultrasound probe orientation for infraclavicular block. **B)** Sonographic image of pediatric infraclavicular block, LC: Lateral cord, PC: Posterior cord, MC: Medial Cord, AA: Axillary Artery, AV: Axillary vein.

Although during blockade, pain was attempted to be alleviated by subcutaneous local anesthetic infiltration, it was obvious that in preschool children, mild sedoanalgesia support is needed to form the blocks. Therefore, we believe that use of this indication may be limited in preschool children. Although better results with multiple injections have been reported, we performed the block with a single-injection technique. We aimed to reduce block performance time and block-related pain by reducing the number of redirections. In the literature, it has already been reported that the same efficacy can be achieved with a single injection. Marie-Christine D et al. observed that the success rate was same regardless of the number of UG infraclavicular block injections (9). Additionally, single-injection technique was easier, faster, and more practical and reliable than multiple-injection technique (9, 10). In our study, we achieved successful and rapid effect with single-injection technique.

In conclusion, we suggest that ultrasound-guided UG infraclavicular block can be used as an effective, fast, and reliable method in selected pediatric patients with dislocation-reduction procedures in ED. Large randomized controlled studies with different pediatric age groups are required to validate these results.

Conflict of interest statement

The authors declare that they have no conflict of interest.

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