ARTICLE COVERSHEET

LWW_CONDENSED(7.75X10.75)

SERVER-BASED

Article : PCARE_210277
Creator : apps_lww
Date : Monday November 29th 2021
Time : 13:48:43
Number of Pages (including this page) : 7

Ultrasound-Guided Regional Anesthesia of the Femoral Nerve in the Pediatric Emergency Department

AQ1 AQ2 *Michael A. Heffler, MD,* Julia A. Brant, MD,†‡ Amar Singh, MD,‡ Amanda G. Toney, MD,*† Maya Harel-Sterling, MD,|| Charlotte Grandjean-Blanchet, MD,|| Antonio Riera, MD,¶ Paul A. Khalil, MD,§ Rebecca L. Starr-Seal, DO,§ and Zachary W. Binder, MD#*

Objectives: Femur fractures are painful, and use of systemic opioids and other sedatives can be dangerous in pediatric patients. The fascia iliaca compartment nerve block and femoral nerve block are regional anesthesia techniques to provide analgesia by anesthetizing the femoral nerve. They are widely used in adult patients and are associated with good effect and reduced opioid use. Ultrasound (US) guidance of nerve blocks can increase their safety and efficacy. We sought to report on the use and safety of US-guided regional anesthesia of the femoral nerve performed by emergency physicians for femur fractures in 6 pediatric emergency departments.

Methods: Records were queried at 6 pediatric EDs across North America to identify patients with femur fractures managed with US-guided regional anesthesia of the femoral nerve between January 1, 2016, and May 1, 2021. Data were abstracted regarding demographics, injury pattern, nerve block technique, and analgesic use before and after nerve block.

Results: Eighty-five cases were identified. Median age was 5 years (interquartile range, 2–9 years). Most patients were male and had sustained blunt trauma (59% low-mechanism falls). Ninety-four percent of injuries were managed operatively. Most patients (79%) received intravenous opioid analgesia before their nerve block. Ropivacaine was the most common local anesthetic used (69% of blocks). No procedural complications or adverse effects were identified.

Conclusions: Ultrasound-guided regional anesthesia of the femoral nerve is widely performed and can be performed safely on pediatric patients by emergency physicians and trainees in the pediatric emergency department.

Key Words: ultrasound, fascia iliaca, nerve block, regional anesthesia, femur fracture, point-of-care ultrasound

(*Pediatr Emer Care* 2021;00: 00–00)

Femur fractures produce significant pain related to muscle spasm and bone contact. Aside from the initial injury, patients often require preoperative splinting, traction, and manipulation of their limb for imaging, which can be significantly painful. This pain has been traditionally managed with systemic opioids, benzodiazepines, or dissociative medications such as ketamine.[1] In pediatrics, this can be particularly challenging, as the risk of respiratory depression from systemic opioids and sedatives is significant.[1] In addition, there is evidence that even a single dose of opioids can lead to increased rates of future addiction.[2] Regional anesthesia has played an increasing role in providing analgesia for pediatric patients with femur fractures in the preoperative setting, helping to reduce the need for systemic opioids and other analgesics.[3] This can be accomplished with nerve blocks targeting the femoral nerve, which innervates a significant portion of the proximal femur and diaphysis.

Regional anesthesia targeting the femoral nerve is practiced commonly by anesthesiologists in the perioperative period. More recently, nerve blocks have been performed at the bedside by emergency physicians (EPs) in pediatric emergency departments (PEDs) to augment pain control.[3] With the increasing availability of ultrasound (US), these nerve blocks are frequently performed under US guidance given the improved safety that US provides.

There are multiple techniques for anesthetizing the femoral nerve.[3,4] A femoral nerve block (FNB) is performed by injecting anesthetic directly adjacent to the femoral nerve. This can be performed using a landmark-based technique, where one inserts the needle lateral to the palpated femoral arterial pulse. Alternatively, FNBs can be performed with US guidance.

The fascia iliaca compartment nerve block (FICNB) is a second technique for anesthetizing the femoral nerve and often the lateral femoral cutaneous nerve as well. A FICNB is performed by injecting anesthetic below the fascia iliaca, superficial to the iliacus muscle, at a point lateral to the femoral neurovascular bundle.[3] Injecting within this fascial plane allows anesthetic to spread medially to the femoral nerve. A landmark-based technique for performing FICNB was first described in 1989, with needle placement along the inguinal ligament at the junction of the middle and lateral thirds to avoid the neurovascular bundle.[5] This approach has been referred to as the "two-pop" or "fascial pop" technique because of the tactile sensation of the needle passing first through the fascia lata and then second through the fascia iliaca. Fascia iliaca compartment nerve block can be performed using real-time US guidance, allowing one to actively visualize the needle tip and safely inject the anesthetic in the desired plane.[3]

When using US, FICNB and FNB are similar procedures. The effect of both nerve blocks is to anesthetize the femoral nerve, and when successful, each results in a similar desired effect.[3] The current report highlights 85 cases of pediatric femur fractures treated with US-guided regional anesthesia of the femoral nerve administered by EPs in the PED at 6 clinical sites across North America.

METHODS

Setting and Population

The cases in this report were retrospectively collected from 6 academic PEDs: 5 in the United States and 1 in Canada. Participating sites were recruited from 1 of 2 preestablished pediatric point-of-care ultrasound (POCUS) networks: Pediatric Emergency POCUS Educational Collaborative and PEMPOCUS (P2). All AQ6

AQ3 From the *Denver Health Medical Center, Denver; †Department of Emergency Medicine, University of Colorado School of Medicine; ‡Children's Hospital Colorado, Aurora, CO; §Norton Children's Hospital, University of Louisville School of Medicine, University of Louisville, Louisville, KY; ||The Hospital for Sick Children, University of Toronto Faculty of Medicine, Toronto, Ontario, Canada; ¶Yale University Hospital, Yale School of Medicine, New Haven, CT; and #UMass Memorial Medical Center, University of Massachusetts Medical School, Worchester, MA.

Disclosure: The authors declare no conflict of interest.

AQ4AQ5 Reprints: Michael A. Heffler, MD, Denver Health Medical Center, 777 Bannock St, MC #0108, Denver, CO 80204 (e-mail: Michael.heffler@denverem.org).

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.pec-online.com).

ISSN: 0749-5161

TABLE 1. Commonly Used Local Anesthetics for Peripheral Nerve Blockade, Shown With Weight-Based Dosing and Recommended Maximum Total Dose

Anesthetic	Maximum Weight-Based Dose	Suggested Maximum Total Dose
Bupivacaine	2 mg/kg	150 mg
Bupivacaine with epinephrine	3 mg/kg	200 mg
Ropivacaine	3 mg/kg	200 mg
Lidocaine	4 mg/kg	300 mg
Lidocaine with epinephrine	7 mg/kg	500 mg

AQ7 Adapted from Gadsen J. Local Anesthetics: Clinical Pharmacology and Rational Selection. The New York School of Regional Anesthesia website, October 2013.

clinical sites that were members of either network and routinely perform US-guided regional anesthesia of the femoral nerve were asked to participate. Any clinical site that volunteered to participate was included. Cases were identified by 1 of 3 methods. First is by querying the electronic medical record to identify patients younger than 18 years, with *International Classification of Diseases* diagnosis of S72* (femur fracture). Medical charts were then manually reviewed by the site collaborator to identify patients who underwent US-guided FICNB or FNB. Second is by reviewing a clinical site's quality assurance image repository such as Qpath (Telexy Healthcare, Maple Ridge, BC, Canada) for all US-guided FICNB or FNB and subsequently reviewing medical charts to include those performed for closed femur fractures. Last is by querying a US procedure logbook maintained by the site director for either FICNB or FNB. All participating sites included procedures performed between January 1, 2016, and May 1, 2021. In all cases, the following data were extracted: patient age, sex, and weight; type of fracture and mechanism of injury; type, dose, and volume of local anesthetic used; additional injuries; medications administered in the PED (eg, narcotics, sedatives, anti-inflammatories, etc); and any procedural complications or adverse effects noted in the ED or during hospitalization.

All chart review and data extraction were performed under approval or exemption from the institutional review board at each clinical site. Extracted, deidentified data were shared between investigators. No identifiable protected health information was shared between investigators at any time.

Nerve Block Technique

The nerve blocks in this case series were all performed by the treating EP and trainees at the bedside in the PED, similar to previously described techniques.[3] The type of anesthetic chosen by the EP was based on the desired duration of effect and hospital formulary availability. Exact dosing and volume of anesthetic for the nerve block were chosen by the treating physician based on choice of anesthetic. Recommended weight based dosing and maximum T1 doses for commonly used local anesthetics are shown in Table 1.

Specific nerve block protocols varied by institutional practice. The following is a representative protocol for performing a US-guided FICNB. The patient was maintained on continuous cardiorespiratory monitoring before, during, and after the procedure. Intravenous (IV) fat emulsion was confirmed to be rapidly available in the event of local anesthetic systemic toxicity (LAST). The ipsilateral groin to the femur fracture was prepped. Ultrasound was used to identify a short-axis view of the femoral neurovascular bundle, the fascia iliaca, and the iliacus muscle (Fig. 1). A needle F1 was then inserted lateral to the femoral nerve and advanced medially using an in-plane technique with real-time US guidance until the needle tip was visualized just deep to the fascia iliaca. After aspiration without blood return, local anesthetic was injected in small aliquots while adjusting the needle to ensure accurate infusion of anesthetic beneath the fascia iliaca. After completing the infusion of anesthetic, the needle was withdrawn. Figure 2 is a still F2 image of a US-guided FICNB with identification of sonographic landmarks. Supplemental Digital Content (Supplementary Video 1, http://links.lww.com/PEC/A840) demonstrates placement of a FICNB under real-time US guidance.

A US-guided FNB would be performed with a very similar protocol, with the key difference of needle tip placement adjacent to the femoral nerve, with the goal of anesthetic spread around the femoral nerve.

RESULTS

A total of 85 cases were identified. A case from each participating institution is highlighted hereinafter. Patients ranged in age from 50 days to 15 years with a median patient age of 5 years (interquartile range [IQR], 2–9 years). The median patient weight was 20.9 kg (IQR, 15.2–32 kg). Female patients comprised 30.6% of the cohort. All injuries were secondary to blunt trauma. The most common mechanism of injury was a fall (58.8% of cases). Operative management was required in 94.1% of cases. Additional traumatic injuries were identified in 12.9%.

In addition to their nerve block, 78.8% of patients received an IV opioid while in the PED, 17.6% received an IV sedative, 8.2% received IV ketamine, 11.8% received ibuprofen, and 12.9% of patients received acetaminophen. Ropivacaine was the most common local anesthetic, used in 69.4% of nerve blocks. Fascia iliaca compartment nerve block was performed in 70 (82.3%) of cases. The median volume of injectate was 0.63 mL/kg (IQR,

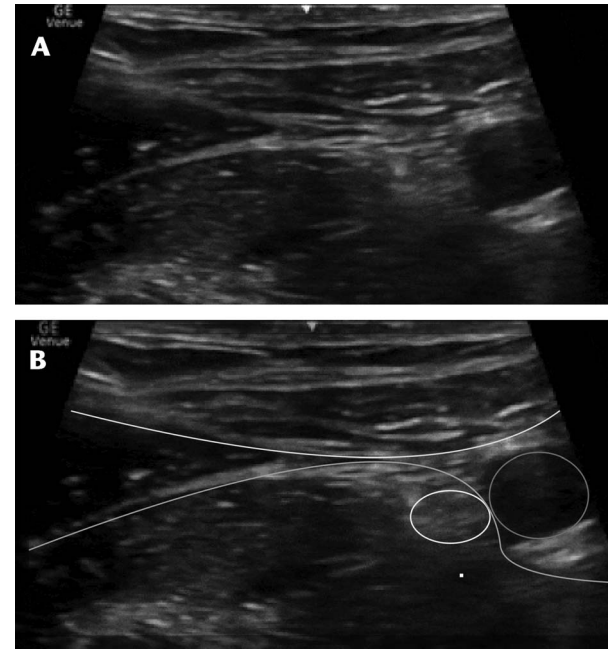

FIGURE 1. A, Ultrasound image showing anatomy of the FICNB. B, Colorized image showing the femoral nerve (yellow) adjacent to the femoral artery (red). Fascia lata (blue) is superficial to the sartorius muscle, and fascia iliaca is between sartorius and iliacus, separating the nerve from the artery.

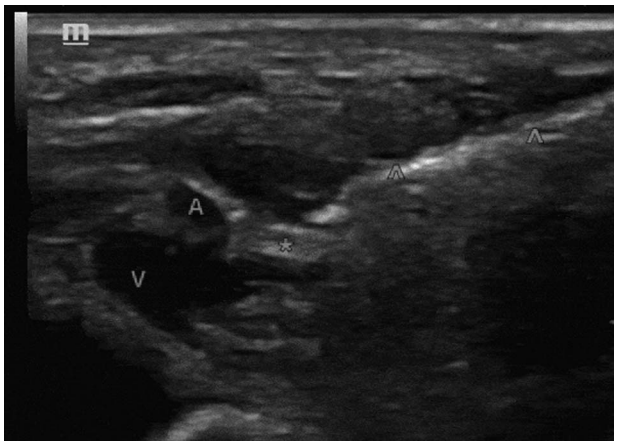

FIGURE 2. A US image demonstrating the FICNB placement. The needle (^) is seen depositing anesthetic adjacent to the femoral nerve (*). The femoral artery (A) and vein (V) are seen medial to the nerve.

0.38–0.95 mL/kg), 0.79 mL/kg (IQR, 0.46–0.96 mL/kg) for FICNB, and 0.36 mL/kg (0.25–0.40) for FNB, respectively. Summary statistics are presented in Table 2. No significant complications or adverse effects were reported.

Case 1: Children's Hospital Colorado

A 50-day-old infant was transferred from an outside hospital (OSH) for evaluation and management of suspected nonaccidental trauma. He was diagnosed with a closed angulated displaced midshaft femur fracture, a healing clavicle fracture, healing rib fractures, and a subdural hematoma. He received 0.05 mg/kg of IV morphine on arrival. To facilitate passive closed reduction of his femur fracture, a US-guided FICNB was performed in the PED using 2.92 mL (0.75 mL/kg) of 0.2% ropivacaine. There were no procedural complications. He did not require additional IV analgesia while in the PED. He was placed in a Pavlik harness, admitted, and radiographs the next morning were improved. The remainder of the nonaccidental trauma workup was completed, and his injuries were managed nonoperatively before discharge.

Case 2: Denver Health Medical Center

A 7-year-old girl presented to the PED after she fell off a trampoline. She was diagnosed with an isolated closed spiral midshaft femur fracture. She received 1 mg of IV morphine on arrival to the PED and a 0.5 mg dose shortly after. Her pain improved after receiving a US-guided FICNB using 16 mL (0.78 mL/kg) of 0.25% bupivacaine. There were no procedural complications. She received 1 mg of morphine after the procedure to facilitate placement in Buck's traction. She was then admitted for open reduction and internal fixation the next morning. She did not require additional preoperative parenteral analgesics.

Case 3: University of Massachusetts

A 2-year-old boy with autism was transferred from an OSH for management of a closed spiral midshaft femur fracture after falling off an indoor trampoline. The patient received a single dose of acetaminophen (15 mg/kg), and his leg was splinted before transfer. On arrival to the PED, the patient was in persistent pain. Given orthopedic surgery's plan to perform closed reduction and casting in the operating room (OR) the following day, a US-guided FICNB was placed by the PED team using 5.5 mL (0.39 mL/kg) of 0.5% bupivacaine diluted in 14.5 mL of normal saline. There were no procedural complications. The block was effective, and the patient did not require additional preoperative analgesia.

Case 4: Yale New Haven Children's Hospital

A 9-year-old girl with osteogenesis imperfecta presented to the PED with a right proximal femur fracture with protrusion

TABLE 2. Descriptive Statistics of the Study Population

Demographics (N = 85)	
Age, median (IQR), y	5 (2–9)
Female sex, n (%)	26 (30.6)
Institution, n (%)	
University of Louisville	48 (56.5)
Denver Health Medical Center	13 (15.3)
Children's Hospital Colorado	11 (12.9)
The Hospital for Sick Children (Toronto)	6 (7.1)
Yale University	5 (5.9)
University of Massachusetts	2 (2.4)
Injury pattern	
Mechanism of injury, n (%)	
Fall	50 (58.8)
High-energy mechanism*	16 (18.8)
Sports related	8 (9.4)
Pathologic fracture	4 (4.7)
Other	7 (8.2)
Laterality, n (%)	
Right	45 (52.9)
Left	40 (47.1)
Additional traumatic injuries, n (%)	11 (12.9)
Operative management, n (%)	80 (94.1)
Pre–block medications given, n (%)	
Opioid	67 (78.8)
Sedative	15 (17.6)
Acetaminophen	11 (12.9)
NSAID	10 (11.8)
Ketamine	7 (8.2)
Block characteristics	
Nerve block technique, n (%)	
FICNB	70 (82.4)
FNB	15 (16.7)
Type of anesthetic, n (%)	
Ropivacaine	59 (69.4)
Bupivacaine	13 (15.3)
Lidocaine	11 (12.9)
Lidocaine/bupivacaine mixture	2 (2.4)
Volume of anesthetic, median (IQR), mL/kg	0.63 (0.38–0.95)
Operator level of experience, n (%)	
US-trained attending physician	12 (14)
Non–US-trained attending physician	10 (11)
Fellow physician†	50 (59)
Resident physician	13 (15)
Nerve block complications, n (%)	0 (0)

*Defined as motorized vehicle collision, motorized vehicle versus pedestrian collision, or fall >15 ft.

†Physician in pediatric emergency medicine or emergency medicine ultrasound fellowship.

NSAID indicates nonsteroidal anti-inflammatory drugs.

F3 of a prior implant through the bone (Fig. 3). She received 3 mg of morphine, and a US-guided FNB was performed with ketamine sedation, using 8 mL (0.36 mL/kg) of 0.5% bupivacaine. There were no procedural complications. The patient was admitted to the hospital preoperatively while awaiting the arrival of a specialized implant that had to be flown in from out of state. Her parents reported that she was able to sleep well and did not require additional IV narcotics 15 hours after the block. The fracture was repaired intraoperatively 20 hours after the block was administered.

Case 5: The Hospital for Sick Children

A 10-month-old infant was transferred from an OSH with a spiral femur fracture, after falling from parent's arms while being carried downstairs. At the transferring facility, he had received IV fentanyl and ketamine to facilitate splint placement. Repeat radiographs in the receiving PED showed suboptimal alignment, requiring further reduction in the OR. In response to the parents request for avoidance of further doses of opioids, the splint was taken down, and a US-guided FNB was performed using 4 mL (0.45 mL/kg) of 1% lidocaine with epinephrine. There were no procedural complications. He was placed in skin traction, admitted to orthopedic surgery, and taken to the OR the next morning for a closed reduction and casting. No further analgesia was required while in the PED.

Case 6: Norton Children's Hospital

A 5-year-old boy presented to the PED with a left midshaft femur fracture sustained when a tombstone fell onto his left leg while visiting a cemetery. The patient received 25 μg of intranasal fentanyl and 2 mg of IV midazolam before receiving a US-guided FICNB using 25 mL (0.85 mL/kg) of 0.2% ropivacaine. There were no procedural complications. The patient's pain improved significantly, and he was subsequently taken to the OR for casting without need for additional preoperative analgesia.

FIGURE 3. Radiograph of injury sustained in case 3. A displaced and angulated proximal femur fracture is seen, with preexisting hardware in place.

DISCUSSION

Although the FICNB has been widely studied and adopted for use in geriatric femur fractures, where it has been noted to reduce pain and the need for systemic analgesia,[6,7] the FICNB was initially described in a pediatric population. Fascia iliaca compartment nerve block without US guidance has been studied in pediatric populations both in the OR and PED setting. A 2007 PED-based randomized controlled trial compared 55 pediatric patients with isolated femur fractures who received a FICNB via landmark technique versus IV morphine sulfate. The FICNB group demonstrated greater pain relief at 30 minutes, increased duration of analgesia, and reduced use of rescue medication.[8] A subsequent single-center, retrospective, observational study in 2014 examined 259 pediatric patients with femur fractures, 158 of whom received FICNB in the PED via landmark technique versus 101 who did not. This study found improved pain scores and fewer doses of systemic analgesia in patients who received a FICNB, with no observed difference in adverse events.[9]

With the increasing availability and use of POCUS, regional anesthesia of the femoral nerve can be performed under real-time US guidance. Multiple case reports have shown US guidance to be effective in guiding nerve block administration in pediatric patients.[10,11] Ultrasound aids in the visualization of the needle tip and ensures accurate placement of the anesthetic bolus, which has been shown to improve the effect of analgesia.[12,13] Furthermore, US provides improved safety as vascular structures can be visualized and avoided. The safety and efficacy of US-guided nerve blocks are recognized in the American College of Emergency Physicians policy statement "Ultrasound-Guided Nerve Blocks" (2021) and the American College of Surgeons guideline "Best Practices Guidelines for Acute Pain Management in Trauma Patients (2020).[14,15]

Ultrasound-guided nerve blocks have been studied for use in pediatric patients with femur fractures, with a 2014 single-center, retrospective, observational cohort study examining 31 pediatric patients with isolated femur fractures treated with US-guided FNBs compared with 50 patients managed with systemic analgesics alone. This study found a reduction in total morphine dose, a reduction in nursing interventions, and a reduction in total pain medication doses.[4]

This multicenter study reports 85 pediatric femur fractures managed with EP performed US-guided regional anesthesia of the femoral nerve (FICNB or FNB) in the PED. There were no recorded adverse effects or complications. The study cohort is heterogeneous with regard to mechanism of injury, type of femur fracture, and choice of anesthetic. The patients were treated at tertiary care centers throughout North America with 6 institutions represented. This is the largest multicenter report on regional anesthesia of the femoral nerve utilizing US guidance and highlights the widespread use and generalizability of these techniques.

Barriers to widespread adaptation of US-guided regional anesthesia of the femoral nerve vary by institution. A commonly encountered barrier is the lack of formal training and credentialing for physicians to perform these blocks. Although POCUS has been incorporated into PEM training, the teaching of regional anesthesia has often been deprioritized compared with other US applications in the PED.[16] Future educational efforts on a national, regional, and institutional level will hopefully enable providers to overcome this barrier.

A second major barrier to implementation of these procedures may be a lack of training overlap between emergency care providers and other surgical and trauma subspecialists. A proactive and collaborative approach is an effective way to overcome this barrier. Two of the included institutions developed policies

for implementation of these procedures by EPs in collaboration with their surgical colleagues. Clear communication with consultants and careful documentation of a baseline neurovascular examination by the consulting team before regional anesthesia administration by the performing EP is essential for optimizing patient care and for fostering confidence in this procedure. There was a large range in number of nerve blocks performed at each site (2–48), illustrating the variable uptake of this procedure at institutions across North America.

This is a retrospective, cross-sectional study, which has limitations. The chart review methods used may have limited inclusion. With electronic medical record queries, patients with multiple traumatic injuries may receive an *International Classification of Diseases, Tenth Revision*, diagnosis that does not specifically include S72* (femur fracture) and thus may not have been identified. Cases may also have been missed if a provider performed a procedure without proper documentation.

An additional limitation is that EPs were not blinded to the study intervention, as they were often both the treating provider and proceduralist. All nerve blocks in this study were performed by EPs with formal POCUS training. Blocks were performed by EPs with PEM or US-specific fellowship level POCUS training in 72.9% of cases.

The retrospective, cross-sectional methodology limits analysis of long-term benefits and adverse effects. The sample size also limits the ability to detect rare adverse effects such as LAST. However, prior research has shown that the majority of serious adverse events secondary to nerve blocks, such as LAST, occur within the first hour of administration, making it unlikely that adverse events were missed.[17] In addition, we are not aware of any cases of compartment syndrome that were masked by regional anesthesia as part of this case series.

Future prospective, blinded work will be required to establish the superiority of US-guided regional anesthesia of the femoral nerve in comparison to systemic medications alone in treating acute pain from pediatric femur fractures. In conclusion, US-guided regional anesthesia of the femoral nerve is widely performed and can be performed safely on pediatric patients by EPs and trainees in the PED.

REFERENCES

1. Ruest S, Anderson A. Management of acute pediatric pain in the emergency department. *Curr Opin Pediatr*. 2016;28:298–304.
2. Shah A, Hayes CJ, Martin BC. Characteristics of initial prescription episodes and likelihood of long-term opioid use — United States, 2006–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66:265–269.
3. Baker MD, Gullett JP. Ultrasound-guided femoral nerve blocks. *Pediatr Emerg Care*. 2015;31:864–868 quiz 869-71.
4. Turner AL, Stevenson MD, Cross KP. Impact of ultrasound-guided femoral nerve blocks in the pediatric emergency department. *Pediatr Emerg Care*. 2014;30:227–229.
5. Dalens B, Vanneuville G, Tanguy A. Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. *Anesth Analg*. 1989; 69:705–713.
6. Foss NB, Kristensen BB, Bundgaard M, et al. Fascia iliaca compartment blockade for acute pain control in hip fracture patients: a randomized, placebo-controlled trial. *Anesthesiology*. 2007;106:773–778.
7. Wan HY, Li SY, Ji W, et al. Fascia iliaca compartment block for perioperative pain management of geriatric patients with hip fractures: a systematic review of randomized controlled trials. *Pain Res Manag*. 2020; 2020:8503963.
8. Wathen JE, Gao D, Merritt G, et al. A randomized controlled trial comparing a fascia iliaca compartment nerve block to a traditional systemic analgesic for femur fractures in a pediatric emergency department. *Ann Emerg Med*. 2007;50:162–171, 171.e1.
9. Neubrand TL, Roswell K, Deakyne S, et al. Fascia iliaca compartment nerve block versus systemic pain control for acute femur fractures in the pediatric emergency department. *Pediatr Emerg Care*. 2014;30:469–473.
10. Binder ZW, Murphy KM, Constantine E. Ultrasound guided posterior tibial nerve block to facilitate foreign body removal in a school-aged child. *Glob Pediatr Health*. 2020;7:2333794X20947982.
11. Moake MM, Presley BC, Barnes RM. Ultrasound-guided posterior tibial nerve block for plantar foot foreign body removal. *Pediatr Emerg Care*. 2020;36:262–265.
12. Dolan J, Williams A, Murney E, et al. Ultrasound guided fascia iliaca block: a comparison with the loss of resistance technique. *Reg Anesth Pain Med*. 2008;33:526–531.
13. Reid N, Stella J, Ryan M, et al. Use of ultrasound to facilitate accurate femoral nerve block in the emergency department. *Emerg Med Australas*. 2009;21:124–130.
14. American College of Emergency Physicians. Ultrasound-guided nerve blocks [policy statement]. Approved April 2021. Available at: https://www.acep.org/patient-care/policy-statements/ultrasound-guided-nerve-blocks/. Accessed May 13, 2021.
15. American College of Surgeons Quality Programs. Best practices guidelines for acute pain management in trauma patients. Approved November 2020. Available at: https://www.facs.org/-/media/files/quality-programs/trauma/tqip/acute_pain_guidelines.ashx. Accessed May 13, 2021.
16. Shefrin AE, Warkentine F, Constantine E, et al. Consensus core point-of-care ultrasound applications for pediatric emergency medicine training. *AEM Educ Train*. 2019;3:251–258.
17. Macfarlane AJR, Gitman M, Bornstein KJ, et al. Updates in our understanding of local anaesthetic systemic toxicity: a narrative review. *Anaesthesia*. 2021;76(suppl 1):27–39.

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

AQ1 = Please confirm if the captured article title is accurate.

AQ2 = Please check if authors name are correctly captured for given names (in red) and surnames (in blue) for indexing after publication.

AQ3 = Please provide more details for the affiliations (ie, division/department).

AQ4 = Please check if the captured corresponding author's information is accurate.

AQ5 = Please provide more details for the corresponding author's information (ie, division/department).

AQ6 = Please expand "PEMPOCUS."

AQ7 = Please confirm if permission was obtained from the mentioned reference.

END OF AUTHOR QUERIES