

Ultrasound Guided Femoral Nerve Blocks and the Management of Elder Patients with Hip Fractures

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Abstract

Hip fractures in the elder population are not infrequent and often result in untreated pain or large quantities of opioid administration. Femoral nerve blocks (FNBs) offer a safe, effective method for improving pain control in the setting of hip fracture, which can be initiated in the emergency department (ED). The use of ultrasound has been shown to improve efficiency and accuracy of FNB with an added benefit of reducing the volume of local anesthetics utilized compared to landmark technique. Prior studies have shown that ultrasound training for FNB proficiency can be easily accomplished in the ED setting. There are relatively few known complications associated with FNBs and published studies on ultrasound-guided FNBs have reported zero complications. After reviewing the available literature, we believe the emergency physician is well suited to perform ultrasound guided FNBs; which will lead to improved pain control, decrease opioid requirements, and can potentially reduce medication-induced delirium in the elder population requiring lower extremity pain control.

Keywords: Femoral nerve blocks; ED setting; Hip fractures; Opioid; Medication-induced delirium

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Introduction

Hip fractures are a common injury in the elder population with over 250,000 cases in 2010 occurring in patients of age 65 and older [1]. Hip fractures are estimated to cost nearly 2.9 billion dollars per year [2]. Adding to these costs are the potential problems that can complicate elder patients' hospital course such as urinary tract infections and the development of delirium. In fact, delirium in elder patients who are admitted to intensive care units has been demonstrated to increase mortality by 26% when compared with those elder patients who do not develop delirium [3]. Several hypotheses exist as to why elder patients develop delirium such as poly-pharmacy, poor control of pain, environmental changes or direct opioid side effects; however there has been no overwhelming evidence to support one hypothesis over another [4,5]. Several studies have been conducted demonstrating the feasibility of femoral nerve blocks (FNBs) from the emergency department [5-10]. Furthermore, numerous studies demonstrate improved pain control and decreased opioid use with implementation of femoral nerve blocks [11,12]. Despite the evidence, institutions often face difficulties when

implementing FNB protocols. In fact, Holdgate et al. revealed that of 36 emergency departments in Australia, in patients who presented with hip fracture (n = 645), only 7% received a FNB [13]. Moreover, Mittal and Vermani conducted a national survey in the United Kingdom (UK) and found that 74% (n = 230) of the UK EDs contacted had ultrasound access. However, only 10% regularly administered ultrasound guided FNBs [14]. In this review, we summarize the use and benefits of FNBs, particularly with regard to hip fractures in the elder population. We also aim to highlight a need for further research into the possible reduction of delirium in the elder population.

Methods

This manuscript is a miniature review and has been conducted at an academic medical center. We searched the current literature available on Cochrane Database and PubMed using combinations of the terms, "ultrasound guided", "femoral nerve block", "three-in-one nerve block", "hip fracture", "femoral fracture", "elderly", "elder", "delirium", and "pain control." Authors are emergency medicine physicians with experience in emergency ultrasound.

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Utility of femoral nerve blocks

FNBs have been used in clinical practice for decades by emergency physicians, orthopedists and anesthesiologists. The clinical applications of FNBs include lacerations to lower extremities, patellar injuries, femoral fractures and hip fractures [6,15-18]. In 2003, emergency department driven research by Fletcher et al demonstrated that FNBs confer improved pain relief when compared to opioid therapy alone [6]. In 2008, orthopedic research performed by Mutty et al demonstrated improved pain management when patients with hip fractures underwent femoral nerve blocks in the emergency department [7]. The Cochrane database last visited this topic in 2003 and their consensus summary states that femoral nerve blocks have been shown to decrease pain in patients with hip fractures when the FNB is performed both in the acute and preoperative setting [19]. Finally, in 2013, a randomized control trial was conducted and demonstrated that patients who received FNBs consistently required less pain medications [16]. There are clear benefits to using FNBs to improving pain and decreasing opioid requirement in patients with femoral and hip fractures.

Ultrasound improves nerve blocks

Femoral nerve blocks can be performed using any of the following techniques: anatomical landmarks, nerve stimulators, and ultrasound guidance (**Table 1**). However, in 1997, Marhofer et al confirmed that ultrasound guided FNBs were statistically superior to nerve stimulator technique in both time of onset and efficacy of procedure [11]. Despite the positive consensus in the literature and across numerous medical specialties, femoral nerve blocks are not being used on a regular basis for pain control in patients with hip fractures [14,15]. Two commonly encountered barriers to implementing FNB protocols include the arguments that FNBs are technically challenging; and that FNBs are associated with complications. The use of point of care ultrasound is a skill that alleviates both challenges and is currently being taught in nearly all specialties. Ultrasound provides a mechanism by which clinicians can directly visualize fascia, vasculature, and nerve. This allows a clinician the ability to guide the needle and safely insert anesthetic solution around the nerve (**Figure 1**). Various studies have been conducted to demonstrate the ease and safety of performing ultrasound guided FNB [15,16,20-22]. Anesthesia and Emergency Medicine literature has demonstrated ultrasound

guided FNBs can lead to faster and improved quality of nerve blocks [9,11,16,20,21]. Lastly, when ultrasound is used, less anesthetic is used to achieve adequate blockade [16,19,23].

Ultrasound guided femoral nerve block training

A common teaching model in medicine comes from the paradigm “see one, do one, teach one.” In medicine, one of the biggest barriers to teaching technically challenging procedures is the lack of direct feedback. When a senior resident or attending cannot see what the junior is doing, anxiety can lead to complications or worse, decreased teaching. When conducting ultrasound guided techniques, senior physicians can be confident in the progress of the procedure because both parties can “watch” the needle as it is directed. Due to ultrasound guidance, performing femoral nerve blocks are now no more difficult or technically challenging than performing an ultrasound guided internal jugular central line where the needle is within millimeters from the carotid artery.

Review of the literature demonstrates that ultrasound guided FNBs can feasibly be taught in the emergency department setting [8,9]. In 2012, a study conducted from the emergency department by Haines et al. demonstrated the ease of learning ultrasound guided femoral nerve blocks by emergency physicians [10]. In fact, emergency medicine residents and attending physicians proved proficient after a 30min lecture and practice on mannequin or real patient. In this study, the supervising ED physician declared a physician competent when the physician was able to successfully conduct femoral nerve blocks on a real patient without requiring assistance [10]. Furthermore, Akhtar et al. demonstrated in 2013 that a one hour training module consisting of didactic lecture and hands-on demonstration on FNBs yielded high competency rates in first year emergency medicine residents both immediately and at three months. A post-test as well as “critical actions checklist” under direct observation of a FNB were utilized to assess competency. After the initial teaching module, 37 of 38 (97%) residents were deemed competent in performing a FNB and at three months, 83% maintained proficiency [8].

Femoral nerve block associated complications

Unlike complex and high-risk procedures, such as central line placement or anatomical landmark guided subclavian central line placement where the clinician is millimeters from an artery and risks complications such as arterial puncture, pneumothorax, and dysrhythmia; femoral nerve blocks under ultrasound guidance are always performed in long axis approach whereby the user directly visualizes the entire length of the needle as it approaches the nerve. Complications that have been associated with femoral

Table 1 Comparison of techniques used for Femoral Nerve Blocks [6,7,10-12,16,21,23,24].

	Advantages	Disadvantages
Blind FNB	Can perform in situations without access to ultrasound	Anatomical variation/obese patients increase complications Increased use of local anesthetic compared to NS and US FNBs
Nerve Stimulator (NS) FNB	Improved quality compared to blind FNB	Longer time to onset Increased local anesthetic requirement compared to US FNB
Ultrasound (US) Guided FNB	Shortest time to onset Least amount of local anesthetic required Greatest quality of pain relief Fewest complications	Requires access to US

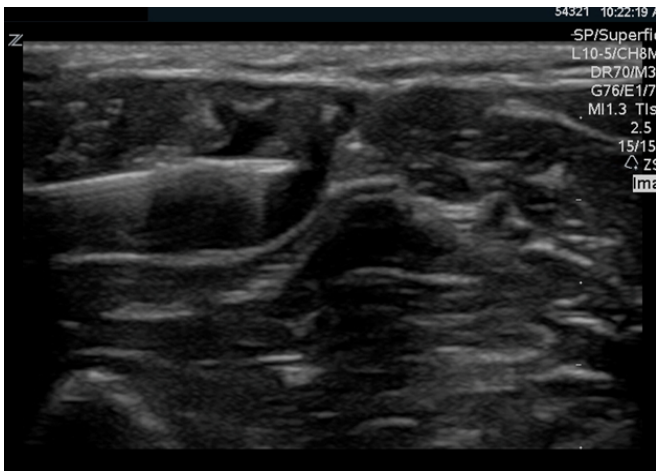


Figure 1 Ultrasound guided nerve block. Image demonstrates a needle being directed towards a triangular shaped nerve. Anesthetic solution is beginning to surround the nerve.

nerve blocks include lidocaine associated local anesthetic systemic toxicity (LAST), direct nerve damage, and infections. Although the potential for these complications exists, they are rare. In fact, a study conducted in 2003 used the anatomical landmark technique and encountered zero complications out of 50 FNBs performed [6]. In 2010 and 2013, ultrasound guidance was used and out of 28 combined nerve blocks performed all were successful and zero had complications [15,16].

Emergency department role

Emergency physicians are the ideal clinicians to care for the pain management of elder patients, because they are the first

physicians to assume the care for these patients and can more quickly address pain control. Fletcher et al. found that patients who were administered a FNB reached their lowest pain score in 2.88 hours versus 5.81 hours in the control group receiving intravenous morphine [6]. Currently, emergency physicians are trained extensively on the use of bedside ultrasound and emergency programs across the country are further developing their ultrasound divisions for the purpose of increasing training and improving patient care. There is still room for improvement, however, as a survey of 242 EDs in five states (Arkansas, Hawaii, Minnesota, Vermont, and Wyoming) found that only 47% of non-academic EDs had point-of-care ultrasound immediately available [24]. The growing number of ultrasound programs has quality assessment means as well as a structured approach to credentialing and documentation [25]. Emergency physicians use the ultrasound to insert central lines, to perform needle guided aspirations of tonsils and peritoneal cavities, and to guide needles into joint spaces in addition to an increasing number of nerve blocks, including FNBs. Certainly a multispecialty approach is necessary and collegial communication is required for the care of elder patients [26]. However, as the evidence of FNBs builds; failing to perform femoral nerve blocks when indicated may soon be negligent.

Conclusion

We have discussed the benefits of clinical application of ultrasound guided FNBs in the setting of hip fracture in the elder population. Multispecialty efforts must be endeavored to improve patient care and decrease the potential for medication-induced delirium in the elder population. Femoral nerve blocks, which can be initiated in the emergency department, can improve pain control in patients with hip fractures and can lead to decreased use of opioid medications.

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