Brief Report

Ultrasound-guided nerve blocks for intracapsular and extracapsular hip fractures

Eitan Dickman, MD a,⁎, Illya Pushkar a, Antonios Likourezos a, Knox Todd, MD b, Ula Hwang, MD c, Saadia Akhtar, MD d, Sean Morrison, MD c

⁎Department of Emergency Medicine, Maimonides Medical Center, 4802 Tenth Ave, Brooklyn, NY 11219
b The University of Texas MD Anderson Cancer Center, 1515 Holcombe Blvd, Houston, TX 77030
c Icahn School of Medicine at Mount Sinai, 1428 Madison Ave, New York, NY 10029
d Mount Sinai Beth Israel, First Avenue at 16th St, New York, NY 10003

ABSTRACT

Objectives: To compare pain relief between patients with intracapsular and extracapsular hip fractures who received an ultrasound-guided femoral nerve block (USFNB).

Design: A multicenter, prospective, randomized, clinical trial.

Setting: The study was conducted in the emergency departments of 3 academic hospitals located in New York City.

Subjects: Patients aged ≥60 years presenting to the emergency department with hip fracture.

Methods: A subgroup analysis from a larger data set was conducted of patients with intracapsular and extracapsular hip fractures who received an USFNB. We compared pain scores at baseline and then at 2 and 3 hours after the nerve block was performed, and also assessed pain relief at 2 and 3 hours.

Results: Seventy-seven patients were randomized to receive USFNB, of which 68 had follow-up data at 2 and 3 hours and were included in the data analysis. Thirty-one were diagnosed with intracapsular and 37 with extracapsular hip fractures. In both groups, reductions in pain scores were clinically and statistically significant. In the intracapsular group, mean pain scores decreased from 6.23 to 3.81 (P < .0001) at 2 hours and from 6.23 to 3.87 (P < .0001) at 3 hours. In the extracapsular group, mean pain scores decreased from 6.62 to 3.89 (P < .0001) at 2 hours and from 6.62 to 3.46 (P < .0001) at 3 hours. These differences were similar between the extracapsular and intracapsular groups at 2 hours (P = .92) and at 3 hours (P = .58), thus demonstrating similar reductions in pain in the 2 groups. The differences in pain relief between the intracapsular and extracapsular groups were also similar: 1.61 (confidence interval [CI], 1.14-2.08) vs 1.35 (CI, 0.96-1.75) at 2 hours (P = .39) and 1.68 (CI, 1.21-2.15) vs 1.38 (CI, 0.89-1.87) at 3 hours (P = .38).

Conclusion: Ultrasound-guided femoral nerve block was equally effective in reducing pain for patients with both intracapsular and extracapsular hip fractures.

Published by Elsevier Inc.

1. Introduction

Hip fracture is a painful orthopedic emergency associated with significant morbidity and mortality in elderly patients [1,2]. Uncontrolled pain from a hip fracture can induce anxiety, fear, and delirium [3,4]. In patients with a hip fracture, delirium is associated with poor functional recovery and increased mortality [5-7].

Patients with acute hip fracture are often initially evaluated in the emergency department (ED), where treatment with systemic opioids is commonly used for pain relief. However, opioid-related adverse effects including nausea, hypotension, and altered mentation occur with increased frequency in elderly patients. Concern for these adverse effects may lead to underdosing of systemic analgesics in this patient population. Oligoanalgesia may lead to continued pain for these patients, as they await definitive surgical repair [8-10].

Regional anesthesia offers a viable alternative to systemic opioids and is strongly endorsed for preoperative pain control in patients with hip fracture by the American Academy of Orthopaedic Surgeons [11]. Specifically, femoral nerve block (FNB) has been established as an effective method for pain control in patients who have sustained this type of injury.
2. Materials and methods

Sized that USFNB would be equally effective in providing pain relief in IC participants. In this subgroup analysis, we used data from a multicenter, prospective, randomized, clinical trial to examine the differences in pain verses EC hip fracture. To our knowledge, no study has investigated whether the hip may be affected depending on whether the patient has an IC or EC fracture. Different branches of the nerves which provide sensory innervation of the hip joint receive sensory innervation from the lateral femoral cutaneous nerve. The skin overlying the hip joint receives sensory innervation from the lateral femoral cutaneous nerve. Hip fractures are classified as intracapsular (IC), composed of subcapital, transcervical, and basicervical fractures, or extracapsular (EC), which consists of intertrochanteric and subtrochanteric fractures. Different branches of the nerves which provide sensory innervation of the hip may be affected depending on whether the patient has an IC vs EC hip fracture. To our knowledge, no study has investigated whether ultrasound-guided FNB (USFNB) is effective in both EC and IC hip fractures. In this subgroup analysis, we used data from a multicenter, prospective, randomized, clinical trial to examine the differences in pain relief provided by USFNB in these 2 types of hip fractures. We hypothesized that USFNB would be equally effective in providing pain relief in IC and EC hip fractures.

2. Materials and methods

This was a subgroup analysis of a multicenter, prospective, randomized, clinical trial comparing USFNB to routine analgesic care (ie, no USFNB) in patients presenting with pain due to hip fracture at 3 academic medical centers. The study enrolled a convenience sample of patients 60 years or older presenting with a hip fracture and was approved by each institution’s institutional review board. Patients were randomized after radiographic confirmation of fracture into 1 of 2 treatment arms: USFNB or standard analgesic care. Investigators used 20 mL of 0.5% bupivacaine to perform the FNB. All participants were asked to assess their pain using an 11-point numeric rating scale (NRS). Baseline NRS scores were recorded at study enrollment and 2 and 3 hours subsequently. In addition, participants evaluated their degree of pain relief using a 6-point NRS (Fig. 1).

In this analysis, we analyzed data for patients enrolled into the USFNB arm only. The primary outcome was the difference in pain reduction provided by USFNB between 2 types of hip fractures at the 2 and 3 hour time points. We used an independent sample t test to assess the difference in pain scores between the 2 groups of fractures at each time point and a paired t test to assess the difference from baseline to each time point within both groups.

2.1. Selection of participants

Patients were eligible to be included in the clinical trial if they were aged 60 years or older, had a confirmed radiographic diagnosis of hip fracture and were able to demonstrate understanding of informed consent. Exclusion criteria included the following: the patient was less than 60 years, the patient was not communicative, or the patient had an allergy to opioids or local anesthetics. See Table 1 for a full list of exclusion criteria.

2.2. Interventions

Study investigators used a Zonare Zone ultrasound machine (Zonare, Mountain View, California) with a high-frequency linear transducer. With the patient in a supine position, the probe was first placed along the femoral crease to view the fascia iliaca and the femoral artery. The femoral nerve was then identified as a hyperechoic structure, positioned lateral to the pulsating artery and deep to the fascia iliaca. After the skin was prepped with antiseptic solution and using sterile technique, a 22-gauge spinal needle was advanced using an out-of-plane approach. With the patient in a supine position, the probe was

![Fig. 1. Pain relief NRS.](image-url)
technique. The advancement of the needle was visualized in order to decrease the risk of inadvertent vascular puncture and to ensure the proper placement of local anesthetic. Every study patient had a physical examination, including a neurovascular assessment, performed either by the Emergency Physician, the Orthopedist, or both, prior to performing the nerve block.

3. Results

Of the 77 participants who were randomized to receive a USFNB, 36 were diagnosed with IC fracture and 41 with EC hip fracture (Fig. 2). We included the 31 IC and 37 EC patients with pain assessments completed at all 3 points. On average, patients with IC fractures were younger than patients with EC fractures (79.71 vs 85.08, \(P < .005\)). Besides age, there were no significant demographic differences between the 2 groups (Table 2). In both groups, reductions in pain scores were clinically and statistically significant at 2 and 3 hours post-baseline (Table 3). These differences were similar between EC and IC groups at 2 hours (\(P = .92\)) and at 3 hours (\(P = .58\)), thus demonstrating similar reduction in pain in the 2 groups (Fig. 3). The differences in pain relief between IC and EC groups were also similar: 1.61 (1.14-2.08) vs 1.35 (0.96-1.75) at 2 hours (\(P = 0.39\)) and 1.68 (1.21-2.15) vs 1.38 (0.89-1.87) at 3 hours (\(P = 0.38\)). Based on post-intervention chart review and daily patient assessments by clinical interviewers, none of the patients who received a USFNB developed an infection due to this procedure.

4. Discussion

The incidence of hip fractures is expected to rise as the population continues to age [22]. Pain caused by a hip fracture can be severe and therefore requires safe and effective treatment. Failure to treat pain in elderly patients is associated with development of delirium, which can impede treatment and recovery [4]. Opiates remain a commonly used analgesic class for patients in pain from hip fracture in the ED. However, untoward side effects of these medications can be exacerbated in the elderly. US-guided regional analgesia has been demonstrated to be safe and effective in treating pain from hip fracture [17–19].

This is the first study to demonstrate that USFNB provides equivalent pain relief in both EC and IC hip fractures. One of the major

Table 2

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Patient characteristics</th>
<th>IC</th>
<th>EC</th>
<th>(P) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>(n (%)/\text{mean (SD)})</td>
<td>(n (%)/\text{mean (SD)})</td>
<td>(P) value</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11 (35.48%)</td>
<td>7 (18.92%)</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20 (64.52%)</td>
<td>30 (81.08%)</td>
<td>.004</td>
<td></td>
</tr>
<tr>
<td>Age (mean)</td>
<td>79.71 (7.79)</td>
<td>85.08 (6.89)</td>
<td>.27</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>(n (%)/\text{mean (SD)})</td>
<td>1 (2.70%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>25 (80.65%)</td>
<td>34 (91.89%)</td>
<td>.541</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>4 (12.90%)</td>
<td>1 (2.70%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>More than 1 race</td>
<td>2 (6.45%)</td>
<td>2 (5.41%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>(n (%)/\text{mean (SD)})</td>
<td>1 (3.23%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>3 (9.68%)</td>
<td>1 (2.70%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Not Hispanic/Latino</td>
<td>27 (87.10%)</td>
<td>34 (91.89%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (3.23%)</td>
<td>2 (5.41%)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Length of stay (mean)</td>
<td>7.77 (4.97)</td>
<td>7.81 (8.06)</td>
<td>.43</td>
<td></td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Patient outcomes</th>
<th>IC ((n = 31))</th>
<th>Mean (95% CI)</th>
<th>Within (P) value</th>
<th>EC ((n = 37))</th>
<th>Mean (95% CI)</th>
<th>Within (P) value</th>
<th>Between (P) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean pain scores at baseline</td>
<td>(6.23 (5.01-7.44))</td>
<td>(6.62 (5.60-7.64))</td>
<td>.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain scores at 2 h</td>
<td>(3.81 (2.58-5.03))</td>
<td>(3.89 (2.75-5.03))</td>
<td>.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain scores at 3 h</td>
<td>(3.87 (2.73-4.77))</td>
<td>(3.46 (2.36-4.56))</td>
<td>.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain relief 2 h</td>
<td>(1.61 (1.14-2.08))</td>
<td>(1.35 (0.96-1.75))</td>
<td>.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain relief 3 h</td>
<td>(1.68 (1.21-2.15))</td>
<td>(1.38 (0.89-1.87))</td>
<td>.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain difference 2 h vs baseline</td>
<td>(2.42 (1.29-3.55))</td>
<td>(&lt;.0001)</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain difference 3 h vs baseline</td>
<td>(2.35 (1.35-3.36))</td>
<td>(&lt;.0001)</td>
<td>.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
limitations of the analysis is that data were obtained only at the 2- and 3-hour time points. It is difficult to predict whether similar reductions in pain relief would continue after 3 hours; the focus of this analysis was on pain relief during the initial treatment, while patients were still in the ED. USFNB serves as an excellent alternative to traditional opioid treatment, thus presenting a means to improve care in this patient population.

5. Conclusion

USFNB is equally effective in reducing pain from hip fracture in both IC and EC subtypes. Health care providers offering emergency care to elderly patients who have sustained an IC or EC hip fracture should strongly consider using USFNB for pain relief.

References