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Comparison of Femoral Nerve Block with Intravenous Morphine Sulfate for Pain Relief of Femoral Fracture

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ABSTRACT

The aim of this study was to compare the analgesic effects of Femoral Nerve Block (FNB) with intravenous Morphine Sulfate in different type of femoral fractures in the emergency department. In this randomized not blind clinical trial all patients aged 15-60 diagnosed as femoral fractures with neurovascular and hemodynamic stability were assessed for eligibility. Patients randomized into two groups to receive either FNB blindly with Lidocaine 1% or intravenous Morphine Sulfate 0.1 mg kg^{-1} the patients`pain score recorded before and 5, 30 and 60 min after intervention using visual analogue scale. The fracture type (neck, inter-trochanteric or shaft of femur) was recorded for all patients. Present results showed that the pain score before and 5 min after intervention was not significantly different between two groups ($p = 0.65$ and $p = 0.77$, respectively) but 30 and 60 min after intervention the pain score in FNB group was significantly lower than that of the Morphine group ($p = 0.002$ and $p = 0.001$, respectively). Comparing the pain score at minute 30, as the primary outcome, was not significantly different in neck of femur fracture ($p = 0.76$), while these differences were significant in inter-trochanteric and shaft of femur fracture ($p = 0.00$ and $p = 0.013$, respectively). Present results showed that the blind FNB could be used as an effective analgesic treatment in patients with femoral fracture.

Key words: Femur fracture, femoral nerve block, pain management, morphine sulfate

INTRODUCTION

Femoral fracture is consisted of neck, inter-trochanteric, diaphyseal and distal fractures. While neck and inter-trochanteric fractures occurs mainly in elderly with minor trauma, diaphyseal and distal fractures results from high-energy injuries (Johnson *et al*., 2014; Mittal and Vermani, 2014). Apart from the underlying cause, patients with fractured femur are in a considerable pain, hence adequate pain management before positioning, transforming and immobilization of patients is crucial.

Femoral fracture pain mainly arises from the periosteum. The nerve supply of femur periosteum is derived principally from the femoral nerve (Tondare and Nadkarni, 1982). Systemic analgesics, mainly narcotics, are commonly used in the Emergency Departments (ED) but their potential side effects including cognitive impairment, respiratory depression and vomiting in

elderly with multiple comorbidity should be taken into consideration before administration (Chau *et al*., 2008). On the other hand, femoral fractures that caused by high-energy injuries would be associated with additional injuries of head, chest or abdomen (Bone *et al*., 2004; Mutty *et al*., 2008). In view of the fact that such patients undergo a usual trauma evaluation, the use of systemic analgesic that depress the central nervous system should be limited to avoid masking other symptoms. Previous studies suggest that the use of local anesthesia in femoral fractures is an effective and safe method including fascia iliaca or femoral nerve block. These methods have been carried out pre-hospital, pre-operation and in the ED setting (Iamaroon *et al*., 2010; Pennington *et al*., 2012; Mutty, 2008; Tondare and Nadkarni, 1982). Femoral Nerve Block (FNB) could be carried out blindly and using a nerve stimulator or ultrasound guidance (Fanara *et al*., 2014). The blind technique need no equipment except a needle. Besides, the emergency physicians especially in the developing countries with a good anatomic knowledge could be trained for this technique easily.

The aim of this study was to compare the effectiveness and side effects of FNB with intravenous Morphine Sulfate in different type of femoral fractures in the emergency department.

MATERIALS AND METHODS

Study design and population: This randomized open-labeled clinical trial was conducted in Imam Khomeini and Golestal educational hospitals, Ahvaz, Iran with almost 100000 and 50000 census patients per year, respectively. During the study period, July 2012 to Febrary 2013, all patients with femoral fracture who were aged 15-60 years old were assessed for eligibility. Before commencement of the study, the Code of Ethics was obtained from the Ethic Committee of Ahvaz Jundishapur University of Medical Sciences and every stage of the study was designed and implemented according to the Helsinki Declaration 1975. Written consent was obtained from all participating patients and confidentiality of patient's personal details was maintained.

Inclusion criteria: Femoral fracture patients who were hemodynamically stabilized, didn't receive pain killers in last 6 h and their pain score was higher than seven based on visual analogue scale were included in the study.

Exclusion criteria: The exclusion criteria were: Abnormal neurovascular exam, hemodynamic instability, pain score less than 7, sensitivity to Morphine Sulfate or Lidocaine, drug addiction, concomitant injuries and Glasco Coma Score less than 14. Patients who were not able to give appropriate response to the questions as a result of unconsciousness or cognitive impairment were excluded too. Patients with severe crush injuries were excluded to avoid thigh compartment syndrom.

Randomization: Eligible patients were randomized between two groups in a 1:1 ratio using a computer-generated code.

Intervention: The first group received Morphine Sulfate (Morphine Sulfate 10 mg mL^{-1}, Darou Pakh, Iran) 0.1 mg kg^{-1} intravenously. In the second group, Femoral Nerve Block (FNB) was performed by the emergency medicine resident who was underwent a training session with an attending previously. In the supine position with both legs extended pulseoximetry and cardiac monitoring were done for all patients. After thorough preparation of the area with an antiseptic,

the needle is introduced at 1 cm lateral to the femoral artery and the 30-40 cc Lidocaine 1% (Lidocaine HCl 2%, 20 mg mL^{-1}, Darou Pakhsh, Iran) at the depth of 2-3 cm was injected after a negative aspiration test. Then, the distal end of injection site was forced down by hand for 5 min to distribute the solution onto proximal area.

Outcome measures: The primary outcome was the pain score at the fracture site based on 10-point Visual Analogue Scale (VAS) 30 min after injection, with 10 indicating the worst pain the patients had ever had and 0 indicating no pain. Patients were asked to rate their pain before drug administration and 5, 30 and 60 min after that and differences in the pain level of 3 or more VAS units was considered significant. After 30 min, if severity of pain was equal to or more than 5 VAS units, 3 μg kg^{-1} Fentanyl (Feniject 0.5 mg 10 mL^{-1}, Aburaihan Co. Iran) was administered intravenously to the patient as rescue therapy. If any degree of pain persisted after 60 min, an additional dose of Fentanyl was administered. The fracture type in each patient was recorded and VAS pain score was compared regarding the fracture type (inter-trochanteric, neck and shaft of femur).

Statistical analysis: To consider, $\alpha = 0.05$, $\beta = 0.2$, power = 80% and the final differences between the two group at least 2 score on VAS, a pilot study with15 patients in each group was carried out and the sample size was calculated at least 30 in each group. Continuous variables were summarized as Mean±SD and categorical variables as ratios. Two-tailed independent t-test was carried out to compare quantitative variables with normal distribution and Chi-Squared was done for comparing qualitative ones.

RESULTS

Of total 110 potential candidate who were assessed for eligibility, 15 patients did not meet the inclusion criteria, 11 declaimed to participate, 21 and 3 patients were excluded as a result of severe concomitant injuries and allergy to the anaesthetic drugs, respectively. Eventually 60 (30 in each group) patients allocated randomly between the two groups and data from these participants were analyzed (Fig. 1).

There was no significant difference regarding age (Mean±SD) between FNB and Morphine group subjects (58.68±25.72 vs. 65.06±21.75, $p = 0.30$). Thirty five patients (58.30%) were male, 15 (50%) and 20 (66.70%) in the FNB and Morphine group.

The VAS pain score was not significantly different between two groups before drug administration ($p = 0.65$). This pattern did not alter five minut after intervention ($p = 0.77$) but at minute 30 and 60 the pain score was significantly lower in the FNB group than that of the Morphine group, $p = 0.002$ and $p = 0.001$, respectively (Fig. 2).

The VAS pain score was compared between the two groups based on the fracture type. Although, the pain score differences was not significant in none of three fracture types before and five minutes after intervention but this pattern showed disparity 30 min later. At 30 and 60 min of intervention, the pain score was significantly lower in patients with shaft of femur and inter-trochanteric fractures who received FNB but in patients with shaft of femor fracture no significant differences were found (Table 1-3).

Mean of pain reduction from baseline to 30 min were calculated based on different fracture types and compared between two treatment groups. This reduction was significantly more in the

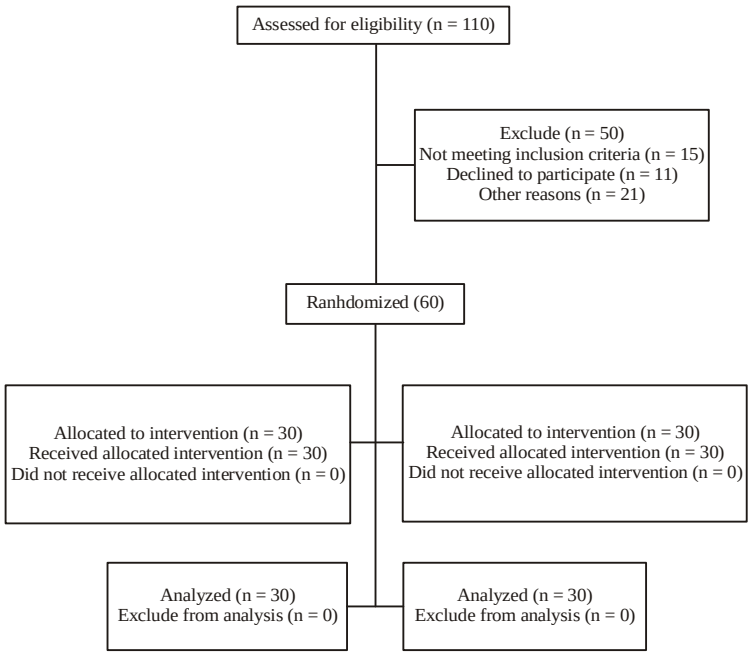

Fig. 1: Randomized clinical trial flowchart of patients to the study

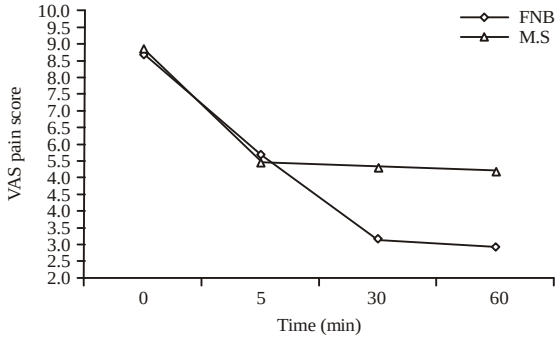

Fig. 2: Comparison of visual analogue scale pain score between femoral nerve block and morphine group across the time

Table 1: Comparison of visual analogue scale pain score before and 5, 30, 60 min after intervention between femoral nerve block and Morphine group in patients with inter-trochanteric fracture

	Inter-trochanteric (30)		
Time (min)	Groups	Pain scores	p-values
0	FNB	8.35±1.21	0.744
	Morphine	8.50±1.15	
5	FNB	5.28±3.38	0.788
	Morphine	5.56±2.12	
30	FNB	2.14±1.75	0.000
	Morphine	5.31±2.12	
60	FNB	1.57±1.65	0.000
	Morphine	4.87±2.27	

FNB group in shaft and inter-trochanteric fractures but in patients with neck of femur fracture the reduction was non-significantly higher in Morphine group than that of FNB group (Fig. 3).

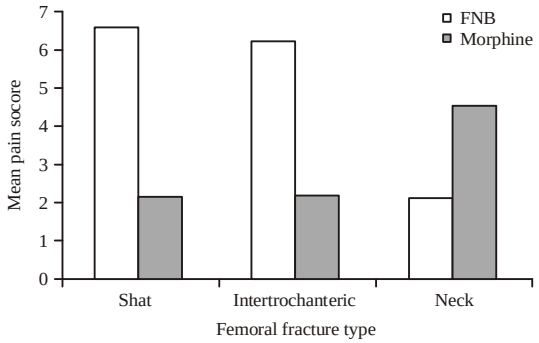

Fig. 3: Comparison of mean pain reduction at 30 min based on visual analogue scale in different femoral fracture types between Femoral Nerve Block (FNB) and Morphine group

Table 2: Comparison of visual analogue scale pain score before and 5, 30, 60 min after intervention between femoral nerve block and Morphine group in patients with shaft of femur fracture

	Shaft (13)		
Time (min)	Groups	Pain scores	p-values
0	FNB	9.28±1.11	0.930
	Morphine	9.33±1.03	
5	FNB	5.14±2.62	0.660
	Morphine	5.83±2.92	
30	FNB	2.71±2.28	0.013
	Morphine	6.16±1.83	
60	FNB	2.28±2.81	0.014
	Morphine	6.33±2.06	

Table 3: Comparison of visual analogue scale pain score before and 5, 30, 60 min after intervention between femoral nerve block and Morphine group in patients with neck of femur fracture

	Neck (17)		
Time (min)	Groups	Pain scores	p-values
0	FNB	8.77±1.09	0.47
	Morphine	9.12±0.83	
5	FNB	6.66±3	0.20
	Morphine	5.00±1.92	
30	FNB	5.11±3.68	0.76
	Morphine	4.62±2.66	
60	FNB	5.11±3.37	0.93
	Morphine	5.00±2.26	

DISCUSSION

This prospective, randomized study demonstrate that femoral nerve block is more effective than intravenouse Morphine in pain reduction of shaft and inter-trochanteric femoral fracture and it is as effective as the systemic analgesic in femoral neck fracture. Although the pain score 5 min after intervention was not different significantly between the two groups ($p = 0.77$) but 30 and 60 min later the differences were significant ($p = 0.002$ and $p = 0.001$, respectively).

The FNB has been used successfully in adults for femoral fracture analgesia in prehospital care or in the ED (Mittal and Vermani, 2014). McGolen *et al.* (1987) evaluated the analgesic effects of FNB with (10 mL 1% Lignocaine with 1:200000 adrenaline) and (10 mL 0 5% bupivacaine) in shaft of femur fracture patients. Although their study did not have a control group but they found that the FNB could be an effective and safe analgesic technique in the emergency department setting (McGlone *et al*., 1987). These results were in accordance with us.

Tondare and Nadkarni (1982) used the FNB in adults and children with shaft of femur fractures. They suggested that the FNB did not have equal effect at different fracture sites. They obtained the best analgesic effects in fractures of the middle-third of femoral shaft (Tondare and Nadkarni, 1982). The study was not a clinical trial and there was no control group.

Sia *et al*. (2014) compared the FNB with the IV Fentanyl before spinal block in femoral fracture patients. They assessed the patients' pain score during positioning based on VAS and concluded the FNB is more effective (Sia *et al*., 2004). But lamaroon *et al*. (2010) conducted the same trial and obtained no significant differences regarding pain score during positioning (Iamaroon *et al*., 2010). Mittal and Vermani (2014) in a review article studied the current usage on the FNB in the emergency departments of UK and they revealed that 46% of the EDs in the UK use the blind method of FNB for femoral fractures (Mittal and Vermani, 2014).

As we mentioned before, our results showed that the FNB is less effective in neck of femur fractures compared with that of shaft and inter-trochanteric fractures. It is suggested that the innervation of joints and bones arise from the muscles around them. Therefore, the nerve supply of femoral neck is mediated via the obturator, sciatic and femoral nerves. The nerve supply of more distal parts, is dominantly arose from femoral nerve, given that the major muscle around is quadriceps (Haddad and Williams, 1995). This hypothesis could be an explanation on the less analgesic effects of the FNB in the neck of femur fracture. Besides, Mutty *et al*. (2008) suggested that femoral nerve block would be more effective for high-energy compared with low-energy femoral fractures. Since, the neck of femur fracture usually occur in elderly patients with low-energy injury mechanism, our patients with neck of femur fracture had the least beneficial of the FNB. Haddad and Williams (1995) compared the analgesic effects of the FNB with systemic analgesic in neck of femur fractures and found the FNB more effective 15 min after intervention ($p<0.05$). Their results are not in line with ours since; they included only extracapsular fractures of femoral neck in their study. Fletcher *et al*. (2003) compared the three-in-one FNB method with IV Morphine in neck of femur fractures. The mean pain score in the FNB group was less compared that of the Morphine group.

To the best of our knowledge, there is no previous clinical trial which compare the analgesic effects of the FNB and Morphine based on the fracture types in the ED.

Unfortunately, our study had a number of limitations. First, we could not conduct a double blind trial, second the gender distribution of our patients was different and the majority of them were male. The third and last limitation was, the different number of patients based on the fracture type which could cause a bias in the analysis of the results.

CONCLUSION

Our results showed that the blind FNB could be used as an effective analgesic treatment in patients with femoral fracture.

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