Original Research Article

Indian Journal of Anesthesia and Analgesia
2018; 5(6): 1022-1026
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.5618.23

Ultrasound Guided Femoral Nerve Block: an Advanced Technique for Pain Relief in Emergency Department in Fracture Femur

Suman Choudhary[1], Sarita Swami[2]

[1]Resident [2]Professor and Head, Department of Anaesthesiology, Bharati Vidyapeeth Medical College and Research Center, Pune.

Abstract

Background: Regional anaesthesia is an established method to provide analgesia for patients in the operating room and during postoperative phase. Ultrasound (USG) guided femoral nerve block offers advantage over intravenous anaesthesia in the acute phase of traumatized patients and during the initial transport of injured patients.The primary objective was to evaluate the pain relief in fracture femur patients using USG guided femoral nerve blocks on arrival in the emergency department. The secondary objective was to compare requirement of supplementation of analgesic and complications in both groups. *Methods:* This prospective interventional study enrolled a sample of 60 patients with fracture femur, 30 in each group. Control group includes patient with conventional analgesia while, in study group ultrasound-guided femoral nerve block was given with inj. bupivacaine 0.25% 10ml in plane approach. Pain score on movement and rest were assessed at baseline and 1 hourly after the procedure for 24 hours. *Results:* All procedures required one attempt, no complications and there was 66% pain relief in study group as compared to control where only 44% relative decrease in pain scores was observed,(P<.005) 1hr to 24hr after procedure. *Conclusions:* USG guided femoral nerve blocks are feasible to perform in the emergency department. Significant and sustained decreases in pain scores were achieved with this technique.

Keywords: Fracture Femur; Femoral Nerve Block; Emergency Department; Ultrasound.

Introduction

Hip fractures are a common presentation to the emergency department and are very frequent among elderly patients. Pain management in such patients is often a challenge due to their advanced age, comorbidities, and increased predisposition to develop adverse effects from medications. Parenteral administration of narcotics has been the mainstay of pain control for such patients which requires intravenous access and has common adverse effects like allergies, sedation, apnea and nausea [1]. There has been an increase in the use of regional anesthesia for a variety of medical procedures. Peripheral nerve blocks result in improved pain control, decreased complications, and a reduced length of stay in the hospital [2]. Ultrasound (USG) guidance to peripheral nerve blocks not only improves accuracy during infiltration of anesthetic but has also decreased the procedural time and time to onset of anesthesia [3]. Patient safety has improved as well because smaller dose of anesthetic agent is required when USG guides the procedure [4]. Femoral nerve blocks are an attractive alternative for pain relief. Peripheral nerve blockade in the acutely injured patient may blunt the systemic inflammatory stress response and reduce the associated risks of thromboembolism and immunesuppression. Additional benefits include reduced risk of opioid- associated complications. Despite the strong evidence supporting their efficacy, safety, and ease of execution, femoral nerve blocks remain relatively underutilized in the emergency department. This study aimed to to compare the pain relief provided by USG guided femoral nerve block

Corresponding Author: Suman Choudhary, Resident, Department of Anaesthesiology, Bharati Vidyapeeth Medical College and Research Center, Pune-Satara Road, Pune, Maharashtra 411043, India.
E-mail: choudharydrsuman@gmail.com

Received on 10.03.2018, **Accepted on** 31.03.2018

and that by routine analgesics. The study also aimed to assess the hemodynamic changes in the patients after receiving USG guided nerve block and any requirement for rescue analgesia.

Methodology

Study Design and Sample

We performed an interventional study of patients who were admitted for fracture femur in the Emergency Department, Bharati Vidyapeeth Medical College and Research Center, Pune from June 2015 till May 2017. We included patients aged 18 to 80 years with fracture femur, of either gender and belonging to American society of anaesthesiologist (ASA) Grade I,II and III. Patients who had hypersensitivity to amide local anaesthetics, had peripheral neuropathy, were haemodynamically unstable, or had head injury with Glasgow coma scale score less than 10 or polytrauma were excluded from the study. We also excluded patients who had wound at the puncture site or infection, had coagulopathies or on anticoagulants, or refused to give consent for inclusion in the study. Patients were assigned randomly to either the study group or the control group. Patients in the study group received USG guided femoral nerve block on arrival in emergency department and patients in the control group received injection Paracetamol 1gm intravenously 6 hourly as per orthopaedic department protocol.

Procedure

Patient was positioned supine with legs slightly abducted: the groin was painted and draped in sterile drape. The USG was placed to the right of the patient's bed, and USG gel was applied to the probe, which was held by an assistant. The probe was placed to the patient's groin with the probe's indicator (a small notch, light, or nub) pointing towards the patient's right leg. In supine position with high frequency linear probe (6-13MHz) femoral artery was identified as a round pulsating vessel and nerve as a triangular or elliptical hyper echoic structure immediately lateral to femoral artery as in Figure 1 and 2. The drug was injected using a 23-gauge spinal needle attached to a syringe with 10 ml of 0.25% bupivacaine, which was inserted 2 cm distal to the inguinal ligament in a lateral to medial direction at a 30-degree angle. The needle was viewed on the USG monitor, the tip was positioned as close as possible to the femoral nerve and aspiration was done to insure there is no infiltration into a vessel. The local anaesthetic was seen spreading in cephalad direction and appeared as an expanding hypo echoic area within the facial space surrounding the nerve sheat as shown in Figure 3.

Fig. 1: Ultrasound probe on right side of patient's groin

Fig. 2: Right side femoral nerve as a triangle lateral to femoral artery

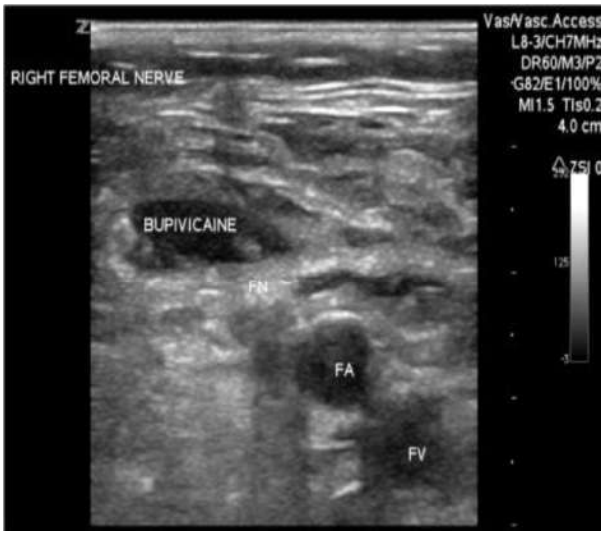

Fig. 3: Ultrasound image of femoral vein, artery (FA), nerve (FN) and inguinal ligament (IL) and expanding bupivacaine around FN

The femoral nerve was anesthetized. Rescueanalgesia was used when the VAS pain score was above 4 and included injection diclofenac and paracetamol 75mg and injection tramadol 100 mg.

Data Collection and Data Analysis

After obtaining approval of the institutional ethics committee, eligible patients were explained the purpose and procedure of the study in the emergency department. A written informed consent was taken from each patient. Baseline demographic information of the patients was collected. Using the visual analogue scale (VAS) pain was assessed for all the patients at rest and at movement [5]. Pulse rate and systolic blood pressure measurements were also noted for all the patient. All observations were made at regular intervals for a period of 24 hours after administration of analgesia. The data was collected using a pre-tested semi-structured proforma. Any requirement of additional analgesia was also noted for all patients. The data were statistically analyzed using Statistical Package for Social Sciences (SPSS ver. 16.0, IBM Corporation, USA) for MS Windows. Qualitative data were compared between the two groups using chi-squared and continuous variables were compared using unpaired t test. The underlying normality assumption was tested before subjecting the study variables to the 't' test. The p-values less than 0.05 are considered to be statistically significant.

Results

Demographic data was comparable in both groups as shown in (table 1) . On arrival in emergency department the mean VAS pain score was significantly higher i.e 8-9 in the both the groups (Table 2). After receiving US guided femoral nerve block in study group VAS score was reduced to 1 from 8 and remained same till 12th hour. However in control group after receiving intravenous paracetamol (1gm) VAS score reduced to 3.07 till 4 hours. This difference in VAS score was statistically significant (p value = 0.001). Due to weaning off action of injectable analgesicsin control group VAS score at the 8th hour increased up to 6.37. However in study group VAS score remained same i.e. 1.03.

Second parameter studied was pain score on movement during transportation. On receiving USG guided femoral nerve block in study group VAS score reduced to 1.03 and remained 3.66 i.e. mild pain over 24 hour duration even on movement for transportation of patient to ward and for imaging. In control group VAS score varied from 2.27 to 6.43 which was mild to moderate pain till 24 hour after receiving intravenous analgesics during movement of patient. Pulse rate was significantly higher at baseline in patients in the study group. However, later during the observation period, pulse rate did not differ between the two groups significantly (Table 3). Mean systolic blood pressure was not

Table 1: Baseline characteristics of patients included in the study

N	Study group 30	Control group 30	p value
Mean age (SD*)	68.9 (14.9)	68.1 (17)	0.83
Gender			
Males	15	14	0.99
Females	15	16	

Table 2: Comparison between study and control groups in mean pain score at rest and movement

Time-line	Mean pain score at rest			Mean pain score at movement		
	Study	Control	p value	Study	Control	p value
Baseline	8.41(0.82)*	9.43(0.50)	0.001	9.72 (0.53)	9.07 (0.74)	0.001
1-Hr	1.00(0.00)	2.13(0.68)	0.001	1.03 (0.19)	2.67 (0.48)	0.001
2-Hr	1.00(0.00)	3.07(1.20)	0.001	1 (0)	2.27 (1.11)	0.001
3-Hr	1.00(0.00)	3.07(1.34)	0.001	1.07 (0.26)	3.87 (1.74)	0.001
4-Hr	1.00(0.00)	3.77(1.33)	0.001	1.41 (0.5)	6.7 (1.51)	0.001
8-Hr	1.00(0.00)	6.37(1.22)	0.001	2 (0)	7.47 (1.22)	0.001
12-Hr	2.07(0.26)	1.60(1.00)	0.018	2.76 (0.43)	1.8 (1.29)	0.001
16-Hr	2.76(0.91)	3.17(0.53)	0.039	3.03 (0.19)	5.63 (0.93)	0.001
20-Hr	3.00(1.31)	2.63(0.56)	0.164	3.59 (0.95)	4.6 (0.89)	0.001
24-Hr	2.62(0.49)	3.93(0.83)	0.001	3.66 (0.67)	6.43 (0.82)	0.001

*Number in parenthesis is standard deviation

Table 3: Comparison between study and control groups in hemodynamic parameters

Time-line	Mean pulse rate			Mean systolic blood pressure		
	Study	Control	p value	Study	Control	p value
Baseline	90.73(5.84)*	81.27(9.04)	0.001	121 (17.7)	118.6 (12.7)	0.549
1-Hr	79.87(5.61)	80.73(7.75)	0.621	113.8 (8.5)	118.3 (11.1)	0.080
2-Hr	80(5.32)	80.53(7.74)	0.760	113.6 (8.2)	116.1 (9.4)	0.273
3-Hr	80.27(5.32)	79.5(7)	0.635	113.6 (7.9)	117.5 (9.4)	0.085
4-Hr	80.33(6.06)	80.27(6.7)	0.968	114.4 (8.4)	117.9 (10.4)	0.162
8-Hr	78.67(5.71)	80.63(6.14)	0.204	116.3 (7.5)	117.5 (8.8)	0.592
12-Hr	79.53(5.79)	80.8(6.53)	0.432	116.7 (6.4)	117.6 (7.3)	0.614
16-Hr	79.8(4.52)	81.93(6.4)	0.134	116.7 (6.9)	119.3 (8.9)	0.211
20-Hr	80.07(4.88)	80.6(6.31)	0.716	116.8 (6.1)	118.6 (8.9)	0.367
24-Hr	80.27(5.06)	80.67(6.57)	0.792	116.4 (5.5)	118.5 (8.3)	0.260

*Number in parenthesis is standard deviation

Table 4: Inter-group comparison of incidence of requirement of additional analgesia

Rescue analgesia	Study group (n=30)	Control group (n=30)	P value
Required	3 (10%)	11 (36.7%)	0.03
Not required	27 (90%)	19 (63.3%)	

different between the two groups at baselines or anytime during the observation period however overall haemodynamic stability was better in study group.

Requirement of rescue analgesia was only 10% in the study group while it was 36% in the control group. (p value = 0.03). These additional doses of analgesia were required during transportation of patients in control group.

Discussion

Nerve block is a relatively new concept in the emergency department for pain relief. Considering the importance of pain management in emergency department and the scarce literature on ultrasound-guided nerve blocks from India, we aimed to evaluate the benefit of femoral nerve block. Finlayson and Underhill first reported applications of regional anestheisa in the emergency department in the late 1980s [6]. Despite its availability for so many years, it has remained relatively underutilized, specially in India [7]. Lack of expertisein performing the procedure, perception that narcotics alone are effective, and safety concerns of the procedure may have hindered the effective implementation of the procedure. Baseline VAS pain score in both the groups in the present study were high i.e 8-9. After receiving USG guided femoral nerve block in study group VAS score reduced to 1. At the same time in control group it was reduced to 3-4. This shows that the control of pain was steady and prolong in study group. However fluctuations over a period of time were seen in control group as the action of conventional analgesia weaned off. Also, VAS pain score on movement was variably high in the control group as compared to a sustain pain relief in study group and this difference was statistically significant. In control group on transportation and movement of patient VAS score fluctuated from 3 to 8 at different intervals of time during 24 hours and required additional drugs for pain control round the clock and patient were discomfortable. However in study group during movement and transportation pain relief was sustained and prolonged and VAS score remained 3.

There are several clinical trials which suggest superiority of USG guided procedure to the one which is landmark or nerve stimulator guided. Marhofer et al found that USG significantly reduced the onset time of the anestheisa, improved the quality of sensory block and reduced the dose of anesthetic required [3]. Ningawal et al. conducted preoperative femoral nerve block in extracapsular femoral neck fractures and evaluated pain relief during transportation to operation theatre [8]. The authors concluded that femoral nerve block provided total pain relief and abolition of muscle spasm within few minutes and caused little change in hemodynamic parameters in patient compared to intramuscular tramadol. Furthermore, Mutty C et aldemonstrated that acute pain of a diaphyseal or distal femoral fracture can be significantly decreased through the use of a femoral nerve block, which can be administered safely in the hospital emergency department [9].

Utilization rates of USG guided nerve blocks are expected to increase with increasing availability of

portable USG machines, and growing evidence suggesting the superiority of ultrasound guidance over landmark and nerve stimulator needle guidance.

Conclusion

Results of the present study show that USG guided femoral nerve block for pain management in the emergency department is an effective method to provide prolonged and sustained pain relief. Additionally, better haemodynamic control was achieved after adequate pain relief using USG guided femoral nerve block. Future studies should assess association of USG guided femoral nerve and the development of delirium and length of stay in the hospital. More research is required to describe different techniques of peripheral nerve blocks which can improve the safety of the procedure.

References

1. Tirado A, Nagdev A, Henningsen C, et al. Ultrasound-guidedproceduresin the emergency department-needle guidance and localization. Emerg Med Clin North Am. 2013;31:87–115.
2. Johnson B, Herring A, Shah S, Krosin M, Mantuani D, Nagdev A. Door- to-block time: prioritizing acute pain management for femoral fractures in the ED. Am J Emerg Med 2014;32:801–03.
3. Marhofer P, Schrogendorfer K, Koinig H, Kapral S, Weinstabl C, Mayer N. Ultrasonographic guidance improves sensory block and onset time of three-in-one blocks. Anesth Analg 1997;85:854–57.
4. Chin KJ, Chan V. Ultrasound-guided peripheral nerve blockade. Curr Opin Anaesthesiol 2008;21:624–631.
5. Haefeli M, Elfering A. Pain assessment. European Spine Journal. 2006 Jan 1;15(1):S17-24.
6. Finlayson BJ, Underhill TJ. Femoral nerve block for analgesia in fractures of the femoral neck. Arch Emerg Med. 1988;5:173–6.
7. Holdgate A, Shepherd SA, Huckson S. Patterns of analgesia for fractured neck of femur in Australian emergency departments. Emerg Med Australas. 2010; 22:3–8.
8. Ningawal BK, Acharya G, Arora KK. Preoperative femoral nerve block in extracapsular femoral neck fractures: a clinical evaluation of pain relief during transportation to operation theatre. World Journal of Phramaceutical and Medical Research. 2016;2(3):143-46.
9. Mutty CE, Jensen EJ, Manka Jr MA, Anders MJ, Bone LB. Femoral nerve block for diaphyseal and distal femoral fractures in the emergency department. JBJS. 2007;89(12):2599-603.