Ultrasound Guided Femoral Nerve Block to Provide Analgesia for Positioning Patients with Femur Fracture Before Subarachnoid Block: Comparison with Intravenous Fentanyl

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ABSTRACT

Background

Positioning patients with fractured femur for subarachnoid block is painful. Intravenous analgesics or peripheral nerve block like femoral nerve block or fascia iliaca compartment block are some of the available techniques to reduce pain. We compared the efficacy of femoral nerve block and intravenous fentanyl in providing effective analgesia before positioning for subarachnoid block.

Objective

This study was designed to compare between ultrasound guided femoral nerve block with lignocaine and intravenous fentanyl in providing effective analgesia before positioning patient with femur fracture in sitting position for subarachnoid block.

Method

Forty patients undergoing surgery for femur fracture were randomized to either femoral nerve block (FNB) or intravenous fentanyl (IVF) group. Group FNB (n=20) received 20 ml of 2% lignocaine around femoral nerve under ultrasound guidance. IVF group (n=20) received 2 mc/kg of fentanyl intravenously. Pain score on effected limb was assessed after five minutes. If VAS was ≤ 4, the patient was positioned in sitting for subarachnoid block. On failure to achieve this with the above treatment, intravenous fentanyl 0.5 mc/kg was administered and repeated as necessary before positioning.

VAS during positioning was documented and compared between the two groups. Similarly, secondary outcomes of the intervention: quality of patient position, rescue analgesia and duration of the procedure were also compared. Data were subjected to Mann Whitney U-test and chi-square test. Level of significance was set at 0.05.

Result

FNB group had significantly less VAS scores (median) than IVF group :2 vs 3; p=0.037) during positioning for spinal anaesthesia. Procedure time (median) for spinal anaesthesia was also significantly less in FNB than in IVA group (10 vs 12 min; p=0.033)

Conclusion

Ultrasound guided femoral nerve block was more effective than intravenous fentanyl for reducing pain in patients with proximal femur fracture before spinal anaesthesia.

KEY WORDS

Femoral nerve block, fractured femur, positioning before subarachnoid block, ultrasound guided

INTRODUCTION

Femur fracture is a common trauma encountered. Subarachnoid block has been the choice of anaesthesia for surgery of these patients.[1,2] However, positioning of these patients for subarachnoid block is challenging because of severe pain during movement. Inability to effectively control pain prior to the procedure increases patient's neuro-hormonal stress response, and may also lead to suboptimal position for the procedure. A good analgesia prior to subarachnoid block for a patient with femur fracture will allow the anaesthesiologist to position his patient optimally. An optimum patient positioning leads to higher success rate of the procedure and provide great patient and clinicians comfort.[3,4]

Current methods of providing analgesia are systemic NSAIDs and opioids, or peripheral nerve block like femoral nerve block or fascia iliaca plane block.

Femoral nerve block is comparatively easy to perform and ultrasound guidance would not only promote preciseness, but also avoid the need of quadriceps twitching by nerve stimulator which would otherwise be painful for a patient with femur fracture.

Use of different regional blocks has been well described for acute pain management of femur fracture and has shown to decrease opioid requirements. However, there are only few studies regarding its use particularly on positioning of patients. Results are variable and a recent study has not been able to demonstrate its superiority in comparison to intravenous opioids.[5] This randomized prospective study has been designed to evaluate the efficacy of femoral nerve block in comparison to intravenous fentanyl for controlling pain on positioning before subarachnoid block.

METHODS

This randomized prospective study was undertaken at Kathmandu University School of Medical Sciences between January 2015 – December 2015. After approval of Institutional Review Committee, Forty American Society of Anaesthesiologists Physical Status (ASA-PS) I and II patients between ages 18-75 years undergoing close reduction fixation for femur fracture and who were unable to sit were enrolled in the study. Those with bleeding diathesis, known adverse reaction to amide local anaesthetics, polytrauma, inability to rate pain score by any reason, use of analgesics 6 hours prior to surgery were excluded from the study.

Selected patients were randomized by sealed envelope technique to either femoral nerve block (FNB) or intravenous fentanyl (IVF) group. All patients were evaluated for preanaesthetic checkup the evening before surgery and informed consent obtained. On arrival to operating theatre, monitors were attached, IV access was obtained with an 18G cannula and ringer lactate administered. Vital signs and Visual Analogue Pain Scale (VAS- 0=no pain, 10=maximal pain) at this time was noted as baseline value. Group FNB (n=20) received 20 ml of 2% lignocaine around femoral nerve using 22 G peripheral stimulating needle (B Braun-Stimuplex) under ultrasound guidance (7.5 MHz linear probe) and in plane approach. IVF group (n=20) received 2 mc/kg of fentanyl intravenously. Five minutes after intervention, VAS was assessed. If VAS was ≤ 4, the patient was assisted in sitting position for subarachnoid block. Upon failure to achieve this score with the above treatment, intravenous fentanyl 0.5 mc/kg was administered and repeated as necessary.

VAS on positioning was documented and compared between the two groups. Quality of patient position and duration of the procedure was assessed as a secondary outcome of the intervention. Quality of patient position was labeled as 3 when optimum, 2 when good, 1 when satisfactory and 0 when poor. Duration of procedure was defined as time beginning from patient position to the end of drug instillation into the subarachnoid space.

Subarachnoid space was approached from midline with 25G Quincke needle between 3rd and 4th lumbar spine. Three ml of 0.5% hyperbaric bupivacaine with 25 mcg fentanyl (total volume of 3.5 ml) was instilled to achieve a block height of T4-T6. Standard monitors; electrocardiography, heart rate, non-invasive blood pressure at five minute interval and pulse oxymetry were monitored.

Data were entered and analyzed using SPSS 17.0. Gender and ASA physical status was analyzed using chi-square test. Age, VAS scores, duration of subarachnoid block, and quality of patient position were analyzed using Mann Whitney U test. P value of less than 0.05 was considered to be statistically significant.

RESULTS

Table 1 represents the demographic data of the patients. The two groups were comparable in terms of age and ASA physical status. Group FNB had higher number of male gender. Baseline values for VAS, heart rate (HR), systolic blood pressure(SBP), diastolic blood pressure (DBP) and oxygen saturations (SPO_2) were also comparable among the two groups (figure 1 and table 2)

Table 1. Demographic data of patients.

Patient data	FNB Mean±SD	FNB Median	IVF Mean±SD	IVF median	p-value
Age (years)	61.85±16.8	65.5	61.65±15.87	65	0.969
ASA physical status					
I	13		11		0.374
II	7		9		
Gender					
Male	15		10		0.095
Female	5		10		

ASA= American Society of Anaesthesiologists

Table 2. Pain scores and secondary outcomes

Patient data	FNB mean±SD	FNB median	IVF mean±SD	IVF median	p-value
VAS(B)	8.6±0.68	9	8.45±0.82	8	0.512
VAS (p)	2.35±0.813	2	2.95±0.826	3	0.037*
VAS (5)	3.4±1.67	3	3.65±1.56	3	0.665
Duration of SAB (min)	10±2.93	10	11.95±2.25	12	0.033*
Quality of patient position	2.35±0.67	2	1.95±0.826	2	0.145

B=baseline; P=during positioning; 5=5 min after spinal anaesthesia; *=p< 0.05

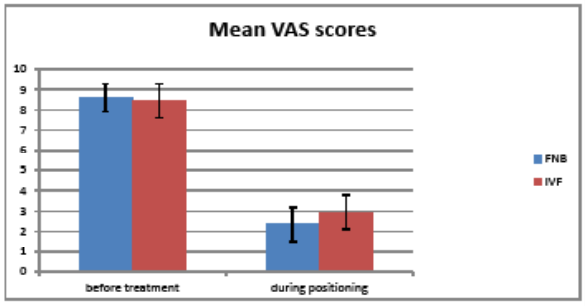

Figure 1. VAS scores

After pain management, group FNB had significantly less mean VAS than group IVF(figure 1). Median VAS during positioning was 2 in FNB versus 3 in group IVF (p=0.037). In order to achieve a target VAS of 4 before positioning, three patients in each group needed rescue fentanyl.

Primary and secondary outcomes of patient after the pain management are shown in table 2. Duration of performance of subarachnoid block was significantly less in FNB than in IVF group(p=0.033).

Optimum positioning was attainable in nine patients in FNB, while only six patients in IVF could achive this (figure 2). Performer rated quality of patient position (mean±SD) was 2.35± 0.67 in FNB which is higher than in IVF (1.95±0.82) but this difference was not statistically significant (p=0.145)

Systolic and diastolic blood pressures and heart rates, before, during positioning and 5 minutes after spinal anaesthesia were comparable among the groups (table 3). SpO_2 was significantly lower in IVF group during positioning

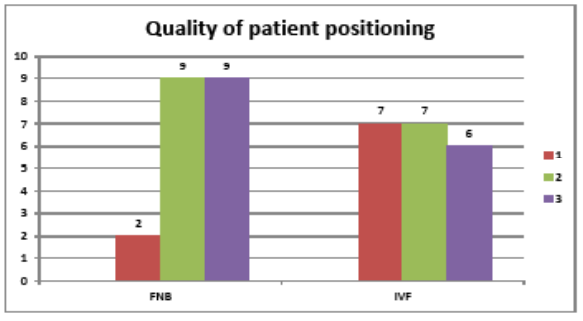

Figure 2. Quality of patient positioning

(95 vs 97; p<0.001)and 5 minutes after (95 vs 98; p<0.001). However, none of the patients in either group had their oxygen saturation below 90%.

There was no inadvertent vascular puncture or adverse effect of systemic local anaesthetic toxicity in the study group

Table 3. Perioperative vitals.

Patient vitals	FNB Mean±SD	FNB Median	IVF Mean±SD	IVF median	p-value
SBP (B)	126.9±16.03	122	127±17.22	121	0.930
SBP (P)	128.85±13.71	126	127.7±15.53	122	0.625
SBP(5)	120.35±17.55	122	118.85±13.14	121	0.925
DBP (B)	83.4±9.78	82	82.8±11.11	82	0.899
DBP (P)	83.84±10.92	80	84.5±11.79	82	0.899
DBP (5)	78.85±10.87	78.5	77.5±10.78	77	0.794
HR(B)	77.15±9.56	74	75±13.73	72	0.440
HR(P)	79.8±10.81	76	77.7±14.05	74	0.559
HR(5)	79.7±10.11	78	79.3±11.28	77	0.783
SpO_2(B)	97.35±1.34	97	97.4±1.04	97.5	0.905
SpO_2(P)	97.35±0.933	97	95.2±1.64	95	<0.001*
SpO_2(5)	97.4±0.99	98	95.1±1.25	95	<0.001*

B=baseline; P=during positioning; 5=5min after spinal anaesthesia; *=p< 0.05

DISCUSSION

In our study FNB provided optimal analgesia for positioning patients with proximal femur fracture for subarachnoid block.

Use of various regional blocks have been well described for acute pain management in patients with femur fracture. They have been found to be superior to systemic analgesia in pre-hospital or emergency setting.

Hurlay K et al. demonstrated that femoral nerve blocks provided faster pain relief than systemic analgesia and decreased opiate requirements in adults with isolated hip fracture.[6] Beaudoin FL et al. also demonstrated significantly reduced pain scores and decreased need for rescue analgesia when ultrasound guided femoral nerve block was compared to parenteral opioids in patients with hip fracture.[7]

In another study done by Szucs S et al. continuous femoral nerve block provided more effective preoperative analgesia than a standard opiate-based regimen for a patient undergoing fixation of femoral neck fracture.[8]

Haddad FS also described femoral nerve block as effective analgesia for femur fracture.[9] Many other studies have successfully used fascia iliaca compartment block for acute pain relief in hip fracture patients.[10-12]

Results are variable for the studies that have compared femoral nerve block with intravenous opioids for positioning patient with femur fracture for spinal anaesthesia. Lamaroon A et al. compared nerve stimulator guided femoral nerve block with bupivacaine versus intravenous fentanyl.[5] This study was unable to demonstrate any benefit of femoral nerve block over intravenous fentanyl for patient positioning before spinal block. However, Sia S et al. concluded in their research that femoral nerve block was more advantageous than intravenous administration of fentanyl for sitting position for spinal anaesthesia in patients undergoing surgery for shaft of femur fracture. The author had used lignocaine, which has an onset of 5 minutes, while it takes 20 minutes for bupivacaine.[13,14] We had used lignocaine too. Positioning patients at 5 minutes corresponded to the onset of the drug and hence better results. Use of ultrasound for precise location of nerve and real time visualization of drug deposition might have contributed to further to good efficacy of the block in our study. There is sufficient evidence that ultrasound guidance increases efficiency of any regional blocks.[15]

Reddy DE et al. in their study demonstrated superiority of femoral nerve block over IV opioids for positioning patients with proximal femur fracture.[16] This study reported a significant difference in pain scores as well as quality of patient positioning and duration of subarachnoid block. Perioperative vitals were more stable with a stable oxygen saturation in the group who underwent femoral nerve block.

Our study was also able to establish a better preoperative pain management with femoral nerve block.

A similar study done by Jadon et al. also reported lesser VAS scores, better patient positioning and faster time for anaesthesia with femoral nerve block than with IV fentanyl.[17] Good analgesia provided by femoral nerve block did provide better quality of patient position in our study. Consequently, the time taken for subarachnoid block was significantly less.

Our patients who received fentanyl experienced fall in oxygen saturation, indicating that this might not be the choice of analgesia for elderly patients and those who already have any cardio-respiratory compromise. Studies comparing other forms of regional analgesia with IV opioids for pain control also reveals better oxygen saturations with regional analgesia.[8,18,19] Vats A et al. however did not experience desaturation in the fentanyl group in their study.[20] This group of patients in their study were administered 1 mc/kg of fentanyl, however, our patients received 2 mc/kg.

CONCLUSION

Femoral nerve block provides superior analgesia, better patient positioning and easy performance of spinal anaesthesia in patients with proximal femur fracture in comparison to intravenous fentanyl.

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