Original Article

Journal of Iranian Medical Council, Volume 4, Issue no. 4
http://dx.doi.org/10.18502/jimc.v4i4.8474

Impact of Ultrasound-Guided Femoral Nerve Block on Ease of Positioning for Spinal Anesthesia in Patients with Femoral Fracture

Houman Teymourian and Nima Saeedi*

Department of Anesthesiology, Shohada-e-Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

*** Corresponding author**

Nima Saeedi, MD
Anesthesiology Research Center Shahid Beheshti University of Medical Sciences, Tehran, Iran
Tel: +98 21 2641 8939
Email: nimasaeedi7@yahoo.com

Received: Jul 22 2021
Accepted: Sept 5 2021

Citation to this article:

Teymourian H and Saeedi. Impact of Ultrasound-Guided Femoral Nerve Block on Ease of Positioning for Spinal Anesthesia in Patients with Femoral Fracture. *J Iran Med Counc*. 2021;4(4):274-79.

Abstract

Background: Spinal anesthesia is commonly used for orthopedic surgeries. The most important issue to improve outcome is patient cooperation to have a proper position for reducing pain during spinal anesthesia procedure. However, any change in position is painful which leads to sympathetic activation, tachycardia and hypertension, which may put patients with ischemic heart disease at risk. Peripheral nerve block is a safe and reliable alternative to systemic analgesia. Using the ultrasound-guided method reduces local anesthetics' amount and side effects.

Methods: In this study, 53 patients who came to the operating room with femoral fracture as candidates for spinal anesthesia were enrolled and received ultrasound-guided Femoral Nerve Block (FNB) (10 *ml* Lidocaine 1.5%). Before and after receiving the nerve block, the patients were asked about the severity of their pain using the Numerical Rating Scale (NRS). Both groups of patients and physicians were asked about their satisfaction according to a 5-point Likert scale.

Results: Mean pain intensity in the NRS score at the time of admission to the operating room was 7.6±0.8, which was reduced to 1.8±1.5 after blockade. In this study, 39 (73.5%) patients were very satisfied (Likert scale 5), 10 (18.8%) were satisfied (Likert scale 4), 2 (3.7%) had no opinion (Likert scale 3), 2 (3.7%) were not satisfied (Likert scale 2), and no one was very dissatisfied (Likert scale 1). There was significant difference in physician's satisfaction.

Conclusion: Ultrasound-guided nerve block is a safe and effective method to be used for positioning during spinal anesthesia procedure.

Keywords: Femoral nerve block, Pain management, Trauma, Ultrasonography

Introduction

Femoral fractures are one of the most common surgeries with an annual prevalence of around 2.9 million cases worldwide, with a peak incidence of 34% between age groups of 15-44, 29% between ages 5-14 and 21% in age>60 (1).Spinal anesthesia is commonly used in lower limb orthopedic surgeries and has many benefits including postoperative analgesia, ease of performance, effective analgesia, prevention of respiratory tract complications, Deep Vein Thrombosis (DVT) reduction, and decreased length of hospitalization and mortality (2-5). Despite the mentioned advantages, the method of performing spinal anesthesia in patients with femoral fractures is difficult due to the impossibility of placing the patient in proper position as there is severe pain in the fractured limb. Proper posture during spinal anesthesia is a prerequisite for successful spinal anesthesia.

The most important issue to improve spinal anesthesia success rate is patient cooperation to get a proper position for reducing the pain during spinal anesthesia. However, due to fracture, any change in position is very painful, which leads to sympathetic nervous system activation, followed by tachycardia, hypertension, and increased heart rate, which may increase the risk of cardiovascular problem in affected patients (6). The pain score can have a great impact on patient satisfaction and the quality of the procedure. Ultrasound-guided peripheral nerve block is a safe and reliable alternative to systemic analgesia and an effective intervention for the management of acute limb pain in patients. Ultrasound-guided method reduces local anesthetics' amount and side effects. Anesthesiologists often use narcotic analgesics such as fentanyl for better pain tolerance during proper positioning for spinal anesthesia (7). Intravenous fentanyl is recommended for analgesia in patients with femoral fractures to facilitate spinal anesthesia by preventing pain following position changes. Recent studies suggest that nerve blocks, especially femoral nerve blocks, minimize this severe pain and increase patient satisfaction. On the other hand, the use of narcotics can be associated with certain complications such as hypoventilation, apnea, and chest rigidity. Therefore, this study was done to assess the analgesic effect of femoral nerve block with 10 *ml* of 1.5% lidocaine before spinal anesthesia positioning in patients with femoral fractures. The main purpose of the study was to evaluate pain intensity, quality of patient position, and patient satisfaction.

Materials and Methods

Study design and setting

This study was conducted at Anesthesiology Department, School of Medicine, Shohada Hospital in Tehran, Iran. The study design was approved by the ethics committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (Ethic code: IR.SBMU.RETECH.REC.1400.016). After detailed explanation of the procedure, written informed consent was signed by all enrolled patients. After cardiac monitoring and in sterile condition, they received ultrasound-guided femoral nerve block (10 *ml* Lidocaine 1.5%) in supine position (femoral and obturator block). The patients were asked about their pain level before and after receiving a nerve block according to a numerical rating scale. The difference between the severity of pain before and after the blockade was measured. Patients and physicians rated their satisfaction with the nerve block on a 5-point Likert scale.

Participants

All patients who were candidates for femoral fracture surgery and spinal anesthesia were registered in the study. Patients with neurological defect in physical examination, allergic history to local anesthetics, site infection, hematoma or active bleeding at the site of injection, unstable vital signs or Glasgow coma scale <15, using narcotic agents in the past 6 hours, moderate to severe head trauma, serious thoracic or abdominal or vertebral injuries, mental retardation, and history of seizure were excluded from study.

Data gathering and statistical analysis

Patients' characteristics (age, sex), medical history (history of narcotics use within the past 6 hours and allergy), and vital signs (heart rate and blood pressure) were recorded at the time of entrance to operating room. A complete physical examination of the injured extremity was performed and the patient's pain was measured before and after

femoral block based on Numerical Rating Scale (NRS) and recorded. Under sterile conditions, using a 22 ga. x 50 mm peripheral nerve block needle (Arrow® StimuQuik®, Teleflex, USA), ultrasound-guided femoral nerve block (Sonosite S-Nerve™ Ultrasound System, Soma Tech Intl, USA) was performed with 10 *ml* , 1.5% Lidocaine (Caspian Tamin Pharmaceutical Co., Iran) by a trained anesthesiologist according to the standard guidelines. A linear probe with a frequency of 5-8 MHz was used for ultrasound-guided nerve block. Satisfaction of patient and physician with the procedure was recorded based on 5-point Likert scale. Satisfaction rate ranged from 5 meaning highly satisfied to 1 meaning highly unsatisfied. Data analysis was carried out using SPSS v21 software (IBM, USA). First, descriptive characteristics and frequencies were calculated. Continuous variables were reported as mean ± standard deviation and categorical ones as frequency and percentage.

Results

Baseline characteristics of cases

In this study, 53 patients with the mean age of 44.4±15.2 years received ultrasound-guided femoral nerve block (67.9% male). Mean pain severity on NRS score at the time of operating room admission was 7.6±0.8. Mean systolic blood pressure of patients was 129.8±4.9 and mean pulse rate of patients before nerve block was 89.81±5.1.

Outcomes

Mean pain intensity reduced to 1.8±1.5 after blockade. In general, 39 (73.5%) patients were highly satisfied (Likert scale 5), 10 (18.8%) were satisfied (Likert scale 4), 2 (3.7%) had no opinion (Likert scale 3), 2 (3.7%) were not satisfied (Likert scale 2), and nobody was highly unsatisfied (Likert scale 1) (Figure 1 and Table 1). There was significant difference in physicians' level of satisfaction. Mean systolic blood pressure of patients after nerve block was 111.9±5.2 mmHg ($p<0.001$). Also, mean pulse rate after nerve block was 79.48±6.1 ($p<0.001$) (Table 2).

Table 1. Patient's satisfaction

	Highly satisfied (Likert scale 5)	Satisfied (Likert scale 4)	Neutral and had no opinion (Likert scale 3)	Not satisfied (Likert scale 2)	Highly unsatisfied (Likert scale 1)
Mean	73.5% (39)	18.8% (10)	3.7% (2)	3.7% (2)	0 %

Table 2. Demographic characteristics and NRS

			Before blockade	After blockade	p-value
Age (Years, mean ± SD)		44.4 ± 15.2			
Gender	Male	67.9%			
Female		32.1%			
Heart rate			89.81 ± 5.1	79.48 ± 6.1	p<0.001
Systolic blood pressure (*mmHg*, mean ± SD)			129.8 ± 4.9	111.9 ± 5.2	p<0.001
NRS score (Mean ± SD)			7.6 ± 0.8	1.8 ± 1.5	p<0.05

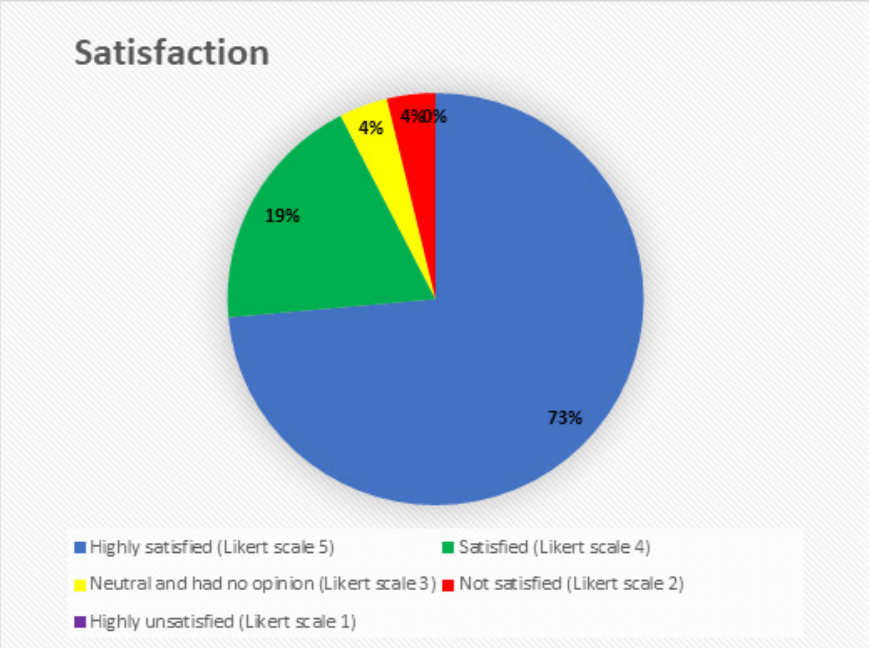

Figure 1. Patient satisfaction.

Discussion

Spinal anesthesia with fewer side effects than general anesthesia and many benefits such as effective analgesia, prevention of respiratory tract complications, reduction of DVT, and reduction in mortality and length of hospitalization is the preferred method in lower limb orthopedic surgery. On the other hand, spinal anesthesia is difficult in patients with a femoral fracture due to severe pain in the fractured limb and difficulty in positioning themselves to perform the procedure. Many methods are recommended to increase patient's cooperation and satisfaction in order to facilitate the performance of spinal anesthesia such as administering intravenous/ intramuscular analgesics and different nerve blocks to induce analgesia in patients with femoral fractures. The analgesic effects of peripheral nerve blocks have been studied in many researches, particularly performing nerve blocks under ultrasound guidance was evaluated with benefits of greater precision and fewer side effects.

Some side effects such as the infection of needle entry sites, hematoma, arterial puncture, phlebitis, and thrombosis are known in blind peripheral nerve blocks and may depend on the anatomic site of the nerve and the type of technique as well as the experience of the person performing the nerve block. Frequent attempts for finding the nerve, injury to the artery or vein, or intravenous/ arterial injection of local anesthetics may occur with nerve stimulator or blind method (without ultrasound guidance) that may lead to systemic side effects which are rare with ultrasound guidance.

In a study conducted by Jadon *et al* on 60 patients, femoral nerve block using a nerve stimulator resulted in better analgesia, patient satisfaction, and a more suitable position than fentanyl IV during spinal anesthesia in patients with femoral fracture (8). A study by Bantie *et al* showed that the femoral nerve block and the fascia iliaca nerve block before surgery in patients undergoing elective surgery for femoral bone fractures reduce pain when positioning the patient, shorten the time for spinal anesthesia, improve the patient's position, and increase acceptance (9). A study conducted by Kacha *et al* in 2018 shows that the fascia Iliaca nerve block effectively provides analgesia for spinal anesthesia positions in patients undergoing femoral and proximal femoral surgery (10). In a study by Gupta *et al*, both Femoral Nerve Block (FNB) and Fascia Iliaca Block (FIB) under ultrasound guidance provided sufficient analgesia to change the patient's position before spinal anesthesia. However, the duration of postoperative analgesia by

the FIB was longer than the FNB (11).

This prospective case series showed that ultrasound-guided nerve block in patients with femoral fracture reduced pain more than 75% and modified it from severe (NRS>8) to tolerable (NRS=2). In this study, patients and physicians were satisfied more than 90% with pain reduction during positioning with this method and 49 (92.4%) patients were satisfied (very satisfied or satisfied) after femoral nerve block while they were completely cooperating during positioning and 4 patients (7.5% of all the patients) were not totally satisfied. There was a significant reduction in blood pressure and heart rate after receiving the nerve block which might have happened due to pain relief and sympathetic nervous system blockade. All anesthesiologists were satisfied with the results. This can be due to the feasibility of patient's positioning, cooperation, and satisfaction after femoral nerve block.

Conclusion

Ultrasound-guided nerve block is a safe and effective method that can be used for positioning during spinal anesthesia procedure. It results in high levels of satisfaction among both patients and physicians.

Acknowledgements

The contribution of Anesthesiology and Orthopedic Departments of Shohada Hospital is appreciated.

Authors' contribution

All authors passed four criteria for authorship contribution based on recommendations of the International Committee of Journal Editors.

Funding

None.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Agarwal-Harding KJ, Meara JG, Greenberg SL, Hagander LE, Zurakowski D, Dyer GS. Estimating the global incidence of femoral fracture from road traffic collisions: a literature review. J Bone Joint Surg Am 2015;97(6):e31.

2. Lončarić-Katušin M, Mišković P, Lavrnja-Skolan V, Katušin J, Bakota B, Žunić J. General versus spinal anaesthesia in proximal femoral fracture surgery–treatment outcomes. Injury 2017;48(suppl 5):S51-S5.

3. Pu X, Sun JM. General anesthesia vs spinal anesthesia for patients undergoing total-hip arthroplasty: A meta-analysis. Medicine (Baltimore) 2019;98(16):e14925.

4. Van Waesberghe J, Stevanovic A, Rossaint R, Coburn M. General vs. neuraxial anaesthesia in hip fracture patients: a systematic review and meta-analysis. BMC Anesthesiol 2017;17(1):87.

5. Jakobsson J, Johnson MZ. Perioperative regional anaesthesia and postoperative longer-term outcomes. F1000Res 2016 Oct 11;5:F1000 Faculty Rev-2501.

6. Diakomi M, Papaioannou M, Mela A, Kouskouni E, Makris A. Preoperative fascia iliaca compartment block for positioning patients with hip fractures for central nervous blockade: a randomized trial. Reg Anesth Pain Med 2014;39(5):394-8.

7. Benyamin R, Trescot AM, Datta S, Buenaventura R, Adlaka R, Sehgal N, et al. Opioid complications and side effects. Pain Physician 2008;11(2 Suppl):S105-S20.

8. Jadon A, Kedia SK, Dixit S, Chakraborty S. Comparative evaluation of femoral nerve block and intravenous fentanyl for positioning during spinal anaesthesia in surgery of femur fracture. Indian J Anaesth 2014;58(6):705-8.

9. Bantie M, Mola S, Girma T, Aweke Z, Neme D, Zemedkun A. Comparing analgesic effect of intravenous fentanyl, femoral nerve block and fascia iliaca block during spinal anesthesia positioning in Elective adult patients undergoing

femoral fracture surgery: a randomized controlled trial. J Pain Res 2020;13:3139-46.

10. Kacha NJ, Jadeja CA, Patel PJ, Chaudhari HB, Jivani JR, Pithadia VS. Comparative study for evaluating efficacy of fascia iliaca compartment block for alleviating pain of positioning for spinal anesthesia in patients with hip and proximal femur fractures. Indian J Orthop 2018;52(2):147-53.

11. Gupta M, Kamath SS. Comparison of preoperative ultrasound guided fascia iliaca block versus femoral nerve block for proximal femur fractures before positioning for spinal anesthesia: an observational study. Korean J Pain 2020;33(2):138-43.