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ORIGINAL ARTICLE:

An Observational Study of Femoral & Lateral Femoral Cutaneous Nerve Block Anesthesia for High-Risk Intertrochanteric Fracture Repair Patients

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ABSTRACT:

Introduction.

Among the elderly, intertrochanteric fracture (IF) is a frequent injury. It could be difficult to provide anesthesia for IF repair due to serious comorbidities. For the most severe instances of IF with contraindications to spinal anesthesia, the authors recommend a femoral nerve block together with a lateral femoral cutaneous nerve block and sedation.

Methods:

A total of 75 individuals were prospectively included in the trial, 25 each of whom underwent general anesthesia, spinal anesthesia, and nerve blocks with sedation.

Results:

According to the anesthesia approach, patients (n = 75) were separated into three groups: GA (general anesthesia, n = 25), SA (spinal anesthesia, n = 25), and PNB (peripheral nerve blocks, n = 25). PNB group had higher NHFS ($p = 0.003$), ASA ($p = 0.002$) as well as a poorer CCI estimate of 10-year survival ($p = 0.012$). The duration of the postoperative stay, survival, incidence of cardiac and cerebrovascular accidents after surgery, loss of independence, and postoperative delirium were comparable across groups.

Conclusions.

A peripheral nerve block may be used during surgery to treat an intertrochanteric fracture using an intramedullary nailing technique in old, weak, and unwell patients. For the repair of IT fractures, the combination of FNB and LFCNB is an effective choice.

Keywords: FNB; LFCNB; Regional nerve block

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MANUSCRIPT:

Introduction:

One of the most frequent injuries needing surgical intervention is the intertrochanteric fracture (IF). Due to the elderly age of the patients and their considerable comorbidities, anesthesia for treating that kind of fracture presents a particularly difficult dilemma for anesthesiologists [1]. The femoral nerve block (FNB) and lateral femoral cutaneous nerve block (LFCNB) are two types of regional anesthesia often used to treat pain in patients with hip fractures [2,3]. In-hospital mortality ranges among patients with hip fractures from 1.6% to 9.7% [4,5], 30-day mortality varies among patients with hip fractures from 6.6% to 10.9% [6,7], and 1-year mortality is reported to vary from 26% to 30.8% [8,9]. Also high is morbidity, which ranges from 17.0% to 49.6% [5,10]. Patients who have been discharged often have decreased mobility and independence and need round-the-clock care. Because of this, IF is a significant public health issue [11].

The day of admission or the day after admission is considered to be the ideal schedule for the procedure [12,13]. Surgery might be postponed due to patient- or administration-related issues. The only recognized reasons of delay are severe medical diseases such anticoagulation, volume depletion, electrolyte imbalance, uncontrolled diabetes, uncontrolled heart failure, correctable cardiac arrhythmia or ischemia, acute chest infection, and worsening of long-term chest disorders [12–15]. Strong data supports the idea that reducing the amount of time between admission and operation lowers mortality and complication rates [16,17].

When surgery is to be done within the proposed time limit, an anesthesiologist often treats patients who have severe systemic illnesses that are poorly managed as well as additional medical issues brought on by the fracture.

For IF repair, spinal anesthesia (SA) may be an option. Coagulopathies, low platelet counts, antiplatelet medication delivery, systemic anticoagulation, issues with adequate patient placement, patient refusal, and the patient's incapacity to participate prevent it from being feasible in all cases. Invasive spine surgeries and neuraxial blocks should be delayed while anticoagulants and antiplatelet medicines are being used, according to current recommendations [18–20]. Most anticoagulants and antiplatelet medications need much more time to stop working before the window of time recommended for trauma hip surgery.

General anesthesia (GA) may be used when SA is not appropriate or contraindicated. Unfortunately, this raises questions regarding the risks of stroke, acute coronary syndrome, and postoperative cognitive dysfunction (POCD) that are connected to anesthesia-induced hypotension [21,22]. Weaning off mechanical breathing may also be challenging due to atelectasis, chest infections, muscular weakness, and slow anesthetic clearance.

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The issue of whether additional anesthesia procedures are beneficial for IF repair arises in light of the time of the operation and the patient's comorbidities. FNB combined with LFCNB and sedation would, in our view, be a better approach. Those may be carried out notwithstanding the patient's hemostasis. The respiratory and circulatory systems are little impacted.

In our facility, patients scheduled for IF repair with poorly controlled systemic disorders, unfavorable health circumstances, and neuraxial block contraindications are given anesthesia using that method. This method is used to adequately finish the process. The limitations of the suggested anesthetic regimen are outweighed by the benefits of being able to perform surgery at all, and notably within the recommended time frame following admission.

Given our prior success with these PNB for IT hip fracture repair, we aimed to determine whether FNB and LFCNB combined with sedation may replace GA or SA for patients at high risk of complications during IT fracture repair.

Methods:

Following approval from Institutional Ethics Committee (IEC Approval No: IEC-SSMC-0146), a prospective, comparative observational study was conducted. An intertrochanteric femur fracture planned for surgical treatment with a Stryker gamma3 intramedullary nailing technique served as the inclusion criteria. One orthopedic team performed all of the surgeries in the highest-caliber medical facility (Shyam shah medical college, Rewa). The study included 75 patients. One attending doctor administered anesthesia. An anesthesia student (MG) conducted a postoperative survey that included information on whether postoperative delirium had occurred.

Anesthesia Methods :

Peripheral Nerve Block: We use a 22G block needle, a linear high-frequency transducer, Sonosite Edge ultrasound equipment, and ropivacaine 0.75%. We limit the volume and/or concentration in severely fragile individuals to 0.5% so as not to exceed the advised dosage of local anesthetic. The patient is positioned supine throughout the procedure. A peripheral IV line is placed, monitoring (SpO2, NIBP, and ECG) is started, and then 50 to 100 mcg of fentanyl is given intravenously. The nerve block is then carried out. A sterile drape is used to prepare and cover the groin. Below the fascia iliaca, the femoral nerve (FN) is located laterally to the femoral artery. The needle is introduced from the lateral to the medial side, in-plane. After careful aspiration and when the needle tip is close to the nerve, 1-2 mL of local anesthetic is administered to check the correct needle placement. Then, depending on the patient's body mass, the visibility of the patient's nerves, or the existence of a hematoma, we inject 15 to 17 mL of local anesthetic. We locate the lateral femoral cutaneous nerve (LFCN) 2-3 cm below the inguinal ligament, laterally to the sartorius muscle, after a successful anesthetic distribution around the FN, and we typically inject 4 to 5 mL of local anesthetic into this area. A 20-minute period is sufficient to induce anesthesia. We gently palpate the hip when the patient states that it

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hurts less when they move the limb. When the patient reports feeling no discomfort upon palpation, he is put on the surgical table. We often avoid doing pinprick tests on patients since cognitive impairment occurs frequently in them. After the block, sedation is administered. To maintain Sp02, oxygen is administered through a face mask at a rate of 2-3 L/min. Propofol boluses are used to elicit sedation in order to perform the surgery and keep the patient comfortable. We want to maintain a level of sedation at 4 on the Ramsay sedation scale. We employ an audible verbal stimulus wherever it is feasible. If not, we gently touch the glabella to determine the level of sedation.

Throughout the whole procedure, the patient breathes on his or her own. Under the face mask, the capnography duct is positioned to track breathing activity. After preparing the surgical area, the surgeon injects 0.5% lidocaine into the anticipated intramedullary nail system entrance locations. IF is often treated by our orthopedic specialists with a Gamma3 by Stryker intramedullary nail. The greater trochanter, the location of the neck screw insertion, and the location of the distal fixation are the three entrance sites into the femur that need to be anaesthetized in order to perform the treatment. During the procedure, we provide 1 g of paracetamol and a proton pump inhibitor. We switch to general anesthesia (GA) if the patient is unable to endure the operation, utilizing sevoflurane in oxygen/air and some fentanyl as an analgesic. The airway is secured with an LMA or endotracheal tube.

Spinal Anesthesia Procedure: With the shattered hip facing up, the patient is positioned in the lateral decubitus posture. We provide 50 mcg to 100 mcg of fentanyl intravenously after inserting a peripheral IV line and starting monitoring (SpO2, NIBP, and ECG). A sterile drape is used to prepare and cover the lumbar region. The expected place of needle insertion is gently infiltrated with 1% lidocaine before SA is obtained with a 25G Quincke spinal needle and 10 to 15 mg of 0.5% isobaric bupivacaine. We provide 1 g of paracetamol and a proton pump inhibitor throughout the procedure. The group under study didn't need to convert SA to GA.

Technique for general anesthesia: The patient is lying on his back. We do fentanyl and propofol induction of GA with a lower dose after a peripheral IV line is placed and monitoring (SpO2, NIBP, ECG) starts. LMA is used to secure the airway. Sevoflurane in oxygen/air is used with age-adjusted MAC to provide anesthesia. We provide 1 g of paracetamol and a proton pump inhibitor throughout the procedure. Due to diminished cardiovascular reserve and predicted hemodynamic instability, ten GA patients needed radial artery cannulation and invasive blood pressure monitoring before induction.

We used the Nottingham Hip Fracture Score (NHFS) to determine perioperative risk. In the NHFS, points are awarded for factors like age (65 years and older receive 0 points, 66 to 85 years receive 3 points, and 86 years receive 4 points), male gender, living in an institution, having more than two comorbid conditions (greater than or equal to two), having had a malignancy within the previous 20 years, and having a low Abbreviated Mental Test Score

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(AMTS of 6 out of 10) [23]. At admission, cognitive impairment was also identified using the AMTS. For dementia-related moderate-severe cognitive loss, a cutoff score of 6 is employed [23]. The NHFS score and 30-day mortality have a positive correlation. When using the NHFS, mortality was computed and ranged from 0.7% for patients who received no points to 45% for those who received a maximum of 10 points [24].

We examined medical data from the information system and had conversations with doctors to determine if any comorbidities were present. We computed the Charlson Comorbidity Index (CCI) using diagnosed comorbidities. We provide two CCI-CCI values: the raw score and the computed likelihood of 10-year survival. The clinical prognosis for patients following hip fracture surgery was shown to be well predicted by CCI [25-27].

Statistical analysis:

Depending on whether the Shapiro-Wilk test revealed that the normal distribution condition had been met, the results were shown as the mean with standard deviation or the median with extreme values. The median with extreme values and the mean with standard deviation were both reported if the normality of the variable distribution varied across groups. Numbers were used to representing nominal variables. If the variables were categorical, the Chi2 test was used to compare the three non-dependent groups; if the normal distribution was lacking, the Kruskal-Wallis test was used instead. Significant two-tailed p 0.05 was used. We assigned 8 consecutive patients to the GA group and the same number to the PNB group to determine the sample size, and we then compared the ASA ratings between the two groups. For the power of the test to be 0.9, the minimum sample size was calculated to be 20 participants in each group, and 15 participants for the power of the test to be 0.8. The SPSS (Statistical Package for the Social Sciences) version 18.0 was utilized for the statistical analysis.

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Results:

According to the anesthesia approach, patients (n = 75) were separated into three groups: GA (general anesthesia, n = 25), SA (spinal anesthesia, n = 25), and PNB (peripheral nerve blocks, n = 25). PNB group had higher NHFS (p = 0.003), ASA (p = 0.002) as well as a poorer CCI estimate of 10-year survival (p = 0.012) (Table 1). The duration of the postoperative stay, survival, incidence of cardiac and cerebrovascular accidents after surgery, loss of independence, and postoperative delirium were comparable across groups (Table 2).

Table 1: Factors contributing to perioperative risk.

Variable	General Anesthesia Mean± SD;	Spinal Anesthesia Mean±SD	Peripheral Nerve Blocks Mean ±SD;	P value
Age	80.8±5.4	82.8±6.7	82.5±8.3	0.0234
Hemoglobin (gm/dl)	12.8±1.8	12.3±1.3	11.3±1.1	0.065
eGFR (ml/min)	89	87	53	0.076
ASA	3	3	4	0.002
NHFS	5.2±2.6	5.5±2.7	6.7±1.8	0.003
CCI	5.9±1.3	6.4±1.6	7.3±1.1	0.0013

Table 2: Treatment outcomes

Variable	General Anesthesia (n=25)	Spinal Anesthesia (n=25)	Peripheral Nerve Blocks (n=25)	P value
Death n (%)	1(4%)	3(12%)	1(4%)	0.567
Cardiovascular and cerebrovascular events after surgery n (%)	0	4(16%)	3(12%)	0.653
Loss of independence n (%)	3(12%)	6(24%)	6(24%)	0.345
Delirium n (%)	11(44%)	10(40%)	11(44%)	0.643
The hospital stays after surgery (days)	7.6	7.9	8.1	0.135

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Discussion:

`The femoral nerve block, in combination with the lateral femoral cutaneous nerve block and sedation, may be an efficient anesthetic method for the majority of severe surgical treatment cases with intertrochanteric fractures with contraindications to SA. With the described technique, hip fracture surgery may be done on patients who are ineligible for GA or SA. It should be emphasized that this kind of surgery is regarded as a life-saving operation and an excellent method to relieve pain. For patients who would have to wait for hemostasis normalization before receiving SA, our method is practical. Additionally, we discovered that individuals with weak respiratory and cardiovascular reserves benefited from this strategy.

They would probably have gotten GA before the peripheral block approach was introduced. Although we cannot specifically list any contraindications, we believe GA is not ideal for these people. We produced pumps with vasopressors, often inserted in arterial and/or central lines, keeping in mind that anesthetics may cause hypotension. Due to this, induction of GA becomes difficult and time-consuming in certain situations, even though the surgical process is often quick and less invasive. As a result, the operating room is utilized less efficiently and turnover time increases. Initially, the research was intended to be a completely randomized controlled experiment. However, those patients who had more comorbidities and poorer clinical circumstances ultimately obtained peripheral nerve blocks more often in the best interests of the patients. Due to more frequent dementia, heart failure, cardiac and cerebrovascular incidents in the past, having an eGFR of 30 mL/min, and having hemoglobin levels below 10 g/l, this explains why the PNB group had higher scores in the ASA, NHFS, and CCI. Additionally, the PNB group got 4 drugs to control chronic conditions more often than the GA and SA groups. The fact that the groups are equivalent and the PNB group had a higher preoperative burden than the GA and SA groups—as shown by the use of the ASA, NHFS, and CCI scales—makes the findings even more credible.

Regarding the optimal time, the preferred method, and the specifics of the treatment, anesthesia to IF fixation may be quite difficult. A frequent treatment option, SA may be contraindicated if a patient has continuous antiplatelet or/and anticoagulant medication or abnormal coagulation test findings. Because there are no standard laboratory tests to rule out the anticoagulation effect, the authors discover that anticoagulation with Direct Oral Anti-Coagulants (DOAC) is more difficult than anticoagulation with conventional vitamin-K antagonists. The anticoagulant effect is often excluded using time-based criteria, but this process may take a very long time in the group of elderly, weak patients who frequently have poor renal function. Our patients most often use clopidogrel, an antiplatelet medication that takes 5 to 7 days to stop working. Because of this, when surgery is scheduled to be done within a suggested window of time, anticoagulant or antiplatelet medication renders the use of SA inapplicable [19,20]. Furthermore, whether we place the patient in a sitting posture or lateral decubitus,

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situating the patient with a hip fracture to continue with spinal anesthesia might cause severe discomfort.

GA may be used when SA is inappropriate or not relevant. However, the use of GA raises questions regarding potential side effects, particularly in the elderly. As previously indicated, people with IF are fragile and have serious comorbidities, including dementia, cardiovascular, respiratory, and renal disorders. These put individuals at a higher risk of experiencing hypotension brought on by anesthesia. Numerous unfavorable consequences, including potentially fatal ones like stroke or myocardial infarction, might result from hypotension.

To decrease the usage of opioids, we first just utilized FNB for postsurgical analgesia. We also began using it to make patient placement before to spinal blocks easier. Next, combined FNB and LFCNB with GA were utilized. During the procedure, we saw no need for extra fentanyl augmentation. The sole opioid utilized throughout the whole surgery was a single dosage of fentanyl given to aid with LMA installation or endotracheal intubation. Three ASA IV patients underwent IF intramedullary nailing under the anesthesia described by Almeida et al. using fascia iliaca block (FIB) and severe sedation [28]. Almeida selected this method due to the delivery of P2Y12 inhibitors and the poor clinical state. Almeida's primary method of anesthesia was FIB. Fentanyl systemic analgesia and propofol sedation were used to control painful stimuli in areas that were innervated by the inferior subcostal and sciatic nerves. It's important to note that throughout the surgery, patients were breathing on their own without the need for airway equipment or mask ventilation. The authors state that all patients' Bispectral Indexes were over 75, limiting the requirement for sedation. Almeida and colleagues come to the conclusion that delaying surgery by a significant amount of these patients choose SA. Two patients with serious heart problems and hip fractures were given surgical anesthesia by Kunisawa using a fascia iliaca block and a high dosage of dexmedetomidine [29]. Similar to Almeida, Kunisawa reports that the block effectively anaesthetized the majority of the fractured bone and almost all locations of anticipated skin incision. Dexmedetomidine infusion was used to control surgical stimulation originating from areas of operated limbs that were not anaesthetized. The surgical treatment was completed with stable cardiac and respiratory conditions. When utilized to give pre- and postoperative analgesia among patients with hip fractures, fascia iliaca block is a secure and reliable method [30]. The innovative strategy was using FIB as a kind of anesthesia. Instead of FIB, we chose to combine FNB and LFCNB with sedation since we discovered that this procedure is more selective when carried out with ultrasound guidance. FNB and LFCNB are reportedly used as a main anesthetic strategy among patients with hip fractures having surgery, according to Johnston and colleagues [31]. They employed a target-controlled infusion of propofol combined with alfentanil as sedatives, which is different from our approach. Since there was no need for ongoing opioid augmentation throughout the treatment, propofol was used to sedate the patient. Even a whole hip implant may be required to fixate a hip fracture [32]. We disagreed with Johnston and colleagues in that we did not believe our approach of anesthesia was appropriate for this treatment since hip arthroplasty is carried out in our Centre through posterolateral or posterior access.

The first limitation of our study stems from the possibility that patients with IF who were admitted to our facility may have installed ankle traction using K-wire. In order to stop additional bone dislocation, ankle traction is employed. Ankle traction is used during IF repair using an intramedullary nail to lessen the fracture. Due to the mobility of the bone fragments and the presence of the K-wire, this stimulates nociceptive receptors in the hip area as well as the ankle. Our approach does not anaesthetize the ankle, thus when using traction with wire, we must provide additional analgesics and sedatives to obtain the necessary level of sedation. We do not need to provide extra sedatives during fracture reduction in IF patients who do not have wire ankle traction since pain signals solely originate from the hip joint, which is appropriately anaesthetized by our approach. Our second worry is that adequate IF reduction sometimes necessitates rotating the inner thigh. This causes the nailing entrance site to be posterior and outside of the area that has been given anesthesia. We thus ask the surgeon to make an incision in the skin where the nail is expected to enter. The sciatic nerve helps to sensory innervate the femur and hip joint, therefore our third worry was whether or not to execute a sciatic nerve block as well. Because of how the patient is positioned in IF, posterior techniques seem to be problematic. The solution looked to be an anterior approach to the sciatic nerve combined with FNB, specifically performed as a SPEDI (Single Penetration Dual Injection) block, however, we encountered technical challenges doing this block effectively [33]. This resulted from a shift in anatomy brought on by hematoma, oedema, and the forced thigh posture brought on by pain. The last issue is the need for sedation while using this method. As previously indicated, a significant majority of people who have hip fractures have cognitive impairment. They cannot undergo the treatment without anesthesia because of their extreme anxiety, the required posture on the operating table, back discomfort, or pain in the opposite hip. Additionally, the surgical area is only partially anaesthetized, which makes it difficult to finish the treatment. The patient's impression of breakthrough pain is prevented by sedation. Although the authors believe sedation is important in this situation, the negative effects of administering anesthetic or sedative medications are well recognized. Propofol's effect ends quickly since we typically only provide tiny dosages of it—100 to 200 mg each instance. We do not see significant respiratory depression or the need for mask ventilation since we supply oxygen and monitor capnography. Propofol is given in boluses after the procedure, such as before heavy hammering or the insertion of a nail. We believe that this method of administering propofol is more useful than continuous infusion.

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