



A STUDY TO COMPARE THREE-IN-ONE NERVE BLOCK AND FASCIA ILIACA COMPARTMENT BLOCK TO FACILITATE POSITIONING OF PATIENTS WITH HIP FRACTURE FOR SPINAL ANESTHESIA

Anaesthesiology

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ABSTRACT

Aim : The aim of this study was to compare analgesic efficacy of three-in-one nerve block (TINB) and fascia iliac compartment block (FICB) to facilitate positioning of patients with hip fracture for spinal anesthesia.

Material and Methods: Sixty adult patients undergoing surgery for hip fracture were randomly allocated to receive either TINB (n=30) or FICB (n=30) using 0.5% ropivacaine under ultrasound guidance. Sensory blockade, VAS score, and hemodynamic monitoring were carried out at 5 minute interval till 20 minutes after the block. Quality of patient positioning and VAS score was noted when the patients were made to sit for spinal anesthesia.

Results: Sensory blockade in lateral compartment of thigh was present in 18 patients in FICB group and 4 patients in TINB group after 10 minutes of nerve block ($p < 0.001$). Sensory blockade was present in 23 patients in FICB group and in 15 patients in TINB group after 20 minutes of nerve block ($p = 0.02$). Complete sensory blockade after 20 minutes of nerve block was present in 22 patients in FICB group and in 14 patients in TINB group ($p = 0.02$). Twenty minutes after the block, VAS decreased from baseline value of 7.70 ± 1.37 (mean \pm SD) to 4.33 ± 1.40 (mean \pm SD) in FICB group and from baseline value of 7.73 ± 1.48 (mean \pm SD) to 4.40 ± 0.81 (mean \pm SD) in TINB group.

Conclusion: FICB is a better analgesic technique as compared to TINB to facilitate sitting position for spinal anesthesia in patients undergoing surgery for hip fracture because sensory blockade of lateral femoral cutaneous nerve is achieved better in FICB as compared to TINB.

Clinical significance: Positioning of the patients with hip fracture for spinal anesthesia is very difficult as even minimal movements of fracture ends are extremely painful; FICB is an effective technique for pain relief during positioning for spinal anesthesia.

KEYWORDS

Positioning of patients; Spinal anesthesia; Fascia iliaca compartment block; Three-in-one nerve block.

Introduction

Hip fractures often occur in the elderly patients who may have many other coexisting medical conditions.¹ Fracture of femur is extremely painful injury because it involves the periosteum which has a very low pain threshold.² Spinal anesthesia is a commonly used technique to facilitate surgical repair in these patients. However, positioning of these patients for spinal anesthesia is very difficult as even minimal movements of fracture ends are very painful.¹ Providing adequate analgesia in these patients helps to improve the positioning for spinal anesthesia.² Patients having pain from hip fractures are often treated with intravenous opioids which are associated with various side effects especially in elderly patients. Opioids are often associated with adverse effects like nausea, vomiting, constipation, delirium, hypotension and respiratory depression. These effects may be exaggerated in elderly patients and require increased patient monitoring.³

Peripheral nerve block is an alternative technique to systemic analgesia. Peripheral nerve blocks are frequently performed by anesthesiologists perioperatively to control pain in patients undergoing hip surgery. This approach is ideally suited for the emergency department environment, where one injection can control pain for prolonged time. There is evidence to suggest that peripheral nerve blocks performed under ultrasonographic guidance decrease the amount of local anesthetic required to achieve sensory blockade and result in increased success rate of the blocks.⁴ In literature femoral nerve block or three-in-one nerve block have been used for providing analgesia in patients with hip fractures. In these nerve blocks local anesthetic solution is placed adjacent to the femoral nerve. While targeting the same nerves local anesthetic solution is placed under the plane of iliaca fascia for fascia iliaca compartment block.⁵

This study was designed to compare three-in-one nerve block and fascia iliaca compartment block to facilitate positioning of patients with hip fracture for spinal anesthesia.

Material and Methods

Sixty patients (ASA I-III) aged between 40-80 years undergoing surgery for hip fracture were included in this study after approval from

hospital ethics committee. Patients having haemorrhagic diathesis, peripheral neuropathy, allergy to amide local anesthetics, mental disorders, expected body weight < 45 kg and patients who refused to participate in the study were not included. Patients were randomly allocated to two groups namely TINB (three-in-one nerve block) and FICB (fascia iliaca compartment block) comprising of 30 patients each. All patients in both groups received 30 ml of 0.5% ropivacaine for nerve block under ultrasound guidance.

The patient, technician making the position for spinal anaesthesia, staff providing the postoperative care and data collector were blinded to group assignment. All the patients were examined one day prior to surgery and subjected to complete physical as well as systemic examination. All routine investigations were carried out in all patients. The purpose and protocol of the study were explained to patients and informed written consent was obtained. Linear visual analogue scale (VAS) on 0-10 cm was explained to the patients for the assessment of pain where 0 denotes no pain and 10 denotes worst pain imaginable. Upon arrival in premedication room, usual monitoring including heart rate (HR), non-invasive blood pressure (NIBP), electrocardiography (ECG) and pulse oximetry (SpO_2) were established. Intravenous line was secured with 18G venous cannula. Images were obtained using a sonosite M-Turbo ultrasound machine with an HFL 38 x 13-16 MHz 40 mm broadband linear array probe.

Three-in-one nerve block

The patient was positioned supine with legs in abducted position. The ultrasound probe was placed in the inguinal crease transverse to the femoral vein and artery. The inguinal ligament was noted as a linear hyperechoic structure. The probe was moved from medial to lateral direction until the femoral vessels were seen. The femoral nerve sheath was identified as a triangular hyperechoic structure. After local skin disinfection, 2ml of 2% lignocaine was infiltrated at the site of needle entry point. A short bevelled 23 G Quincke's spinal needle was introduced through the skin 2 cm below the inguinal ligament from lateral to medial direction at a 30 degree angle. Once the needle came into view on the ultrasound monitor, the needle tip was placed as close as to the femoral nerve. Thirty ml of 0.5% ropivacaine was injected after negative aspiration over 2 to 3 minute period interrupted by

intermittent aspirations. Correct placement of local anesthetic was confirmed by the presence of an expanding hypoechoic area within the fascial plane of the nerve sheath.⁶⁻⁷

Fascia iliaca compartment block

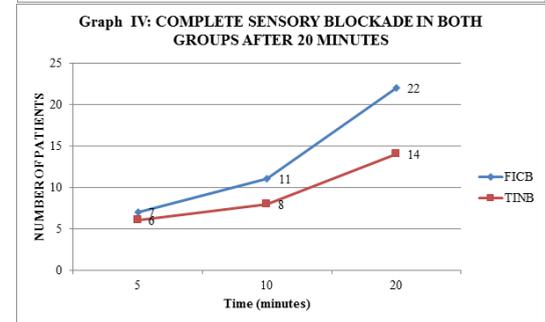
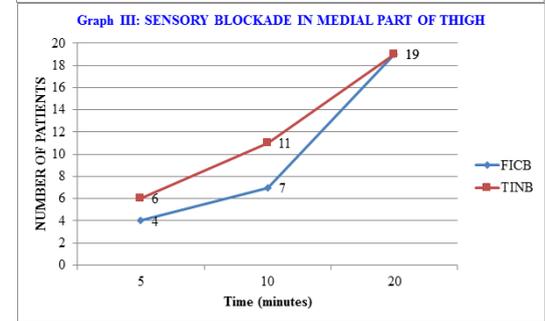
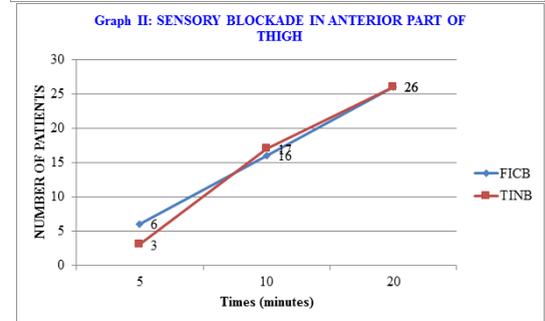
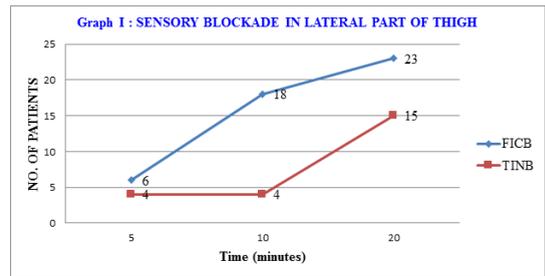
The ultrasound probe was placed on the thigh inferior to inguinal ligament area at one-third of the distance of line joining anterior superior iliac spine (ASIS) to pubic tubercle. The fascial planes of fascia lata and the fascia iliaca were seen as two hyperechoic lines. The fascia iliaca was seen as a bright band covering the iliacus muscle. After local skin disinfection using topical povidone iodine, 2ml of 2% lignocaine was infiltrated to at the site of needle entry point to provide surface anesthesia. A short bevelled 23 G Quincke's spinal needle was introduced through the skin from lateral to medial direction in the plane of the ultrasound probe for visualization of full length of the needle throughout the nerve block procedure. The needle tip was visualized during penetration of fascia lata and then the iliacus fascia. After puncturing of iliacus fascia, thirty ml of 0.5% ropivacaine was injected over a 2-3 min period interrupted by intermittent aspirations. Correct placement of local anesthetic was confirmed by the presence of an expanding hypoechoic area just below the iliacus muscle.⁸

Observations: Sensory blockade was evaluated at 5, 10 and 20 min after ropivacaine administration using loss of perception to cold in the lateral, anterior and medial part of the thigh corresponding to lateral femoral cutaneous, femoral and obturator nerve respectively. Sensory blockade was assessed as follows: Complete block - block in all the three thigh regions; Partial block - block in one or two thigh regions and Block failure - block in no thigh region at 20 min after the local anesthetic injection. After the evaluation of sensory blockade at 20 min, patients were moved to operating room where spinal anesthesia was administered in sitting position. VAS (visual analogue scale) score was noted before the block, 20 min after block and during positioning for spinal anesthesia (approx. 30 min after block). If patient reported a VAS score ≥ 4 during positioning, procedure was stopped, and 30mg of IV ketorolac was given. Positioning was reattempted after reduction of VAS to less than 4. Patient positioning was evaluated as 0=unsatisfactory, 1=satisfactory, 2=good or 3=excellent. Monitoring of HR, ECG, NIBP and SpO₂ was performed at 0, 5, 10 and 20 minutes after the block and then continuously in operating room and recorded. After the completion of surgery, all patients were transferred to post anesthesia care unit (PACU). The severity of pain was assessed by an investigator blinded to group allocation using VAS. All patients were asked to score their pain hourly till 4 hours after completion of surgery and subsequently at 6, 9, 18 and 24 hours. Postoperative analgesia was provided by injection diclofenac sodium 75mg IM when VAS ≥ 4 . In the orthopaedic ward whenever VAS reached ≥ 4 , injection diclofenac sodium 75 mg IM was administered. If pain was not relieved then injection tramadol 100mg IM was administered. Any episode of hypotension (decrease in MAP more than 10% of the baseline value) and bradycardia (heart rate <50) was noted and managed accordingly.

Results:

Sensory blockade in lateral compartment after 10 and 20 minutes was present in significantly more number of patients in FICB group. After 10 minutes, sensory blockade was present in 18 patients in FICB group and in 4 patients in TINB group ($p < 0.001$) (Graph I). Sensory blockade was present in 23 patients in FICB group and in 15 patients in TINB group after 20 minutes ($p = 0.02$) (Graph I). Difference in sensory blockade in anterior and medial compartment between both the groups was statistically insignificant at all time intervals (Graphs II, III). Complete sensory blockade was present in 22 patients in FICB as compared to 14 patients in TINB after 20 minutes ($p < 0.05$) (Graph IV). Complete sensory blockade in both the groups kept on increasing with increasing time intervals. VAS score was noted before the block, 20 minutes after the block and during positioning for spinal anesthesia. Twenty minutes after the block, VAS decreased from baseline value of 7.30 ± 1.37 (mean \pm SD) to 4.33 ± 1.40 (mean \pm SD) in FICB and from baseline value of 7.77 ± 1.48 to 4.40 ± 0.8 in TINB. When compared statistically, improvement in VAS score in both groups was comparable ($p > 0.05$). VAS score was noted during positioning for spinal anesthesia, 26 patients in FICB and 25 patients in TINB had VAS less than 4 while 4 patients in FICB and 5 patients in TINB had VAS ≥ 4 . When compared statistically, there was no significant difference in both groups ($p > 0.05$). VAS score was noted in ward at 6, 8, 10, 20 and 24 hrs. When compared statistically, the difference of VAS between two groups was comparable and insignificant at all time intervals ($p > 0.05$). Analgesic consumption was noted in postoperative

period for 24 hours. When compared statistically, the difference in analgesic consumption in both the groups were insignificant ($p > 0.05$).



Discussion:

The results of our study indicate that FICB is an effective analgesic technique as compared to TINB to facilitate sitting position for spinal anesthesia in patients undergoing surgery for hip fracture, because lateral femoral cutaneous nerve is blocked more effectively in FICB as compared to TINB.

Our findings are supported by a study done by Capdevilla et al who compared TINB and FICB with regards to analgesic efficacy and correlation between radiographic spread of local and clinical anesthetic distribution of anesthesia. They observed that FICB technique provides faster and more consistent simultaneous blockade of lateral femoral cutaneous nerve as compared to TINB technique. They also observed that sensory blockade is caused by spread of local anesthetic solution under the iliacus fascia only and rarely to the lumbar plexus.⁹

In literature, there are variable reports regarding comparison of postoperative analgesic efficacy of FICB and TINB. Although the primary aim of our study did not aim at finding postoperative analgesic efficacy of both the blocks; there was equivalent consumption of analgesics postoperatively in patients who were provided either FICB or TINB.

In a study done by Wallace et al FICB and TINB were compared in adults undergoing knee arthroscopy and meniscal repair. It was observed that both FICB and TINB were effective in providing analgesia, however lateral femoral cutaneous nerve was noted to have achieved higher degree of blockade at all time intervals in FICB group as compared to TINB group same as in our study. However when the percentage of subjects who achieved complete blockade of all three nerves after 30 minutes of block placement was analysed, higher percentage of those in TINB had complete blockade than FICB.¹⁰ Whereas in our study complete blockade was observed in more number of patients in FICB.

The limitation of our study was that we did not use catheter technique for continuous infusion of ropivacaine which would have been better in providing postoperative pain relief as well. In our study equivalent analgesic consumption was observed in postoperative period with both the groups. Since we did not have any control group to compare postoperative analgesic consumption, it is difficult to comment how effective these techniques were in providing postoperative analgesia.

In our study none of the patient had any complication such as hematoma, accidental intravascular injection, block failure and local anesthetic toxicity which can occur with blind techniques.

Therefore to summarize, fascia iliaca compartment block is more effective analgesic technique as compared to three-in-one nerve block technique to facilitate positioning for spinal anesthesia in patients undergoing surgery for hip fracture.'

Conclusion:

The results of our study suggest that fascia iliaca compartment block is better analgesic technique as compared to three-in-one nerve block to facilitate sitting position for spinal anesthesia in patients undergoing surgery for hip fracture. Sensory blockade of lateral femoral cutaneous nerve is achieved better in fascia iliaca compartment block as compared to three-in-one nerve block. Complete sensory blockade is observed in significantly more number of patients who are administered fascia iliaca compartment block as compared to those who are administered three-in-one nerve block. Both fascia iliaca compartment block and three-in-one nerve block are associated with equivalent analgesic consumption in postoperative period.

REFERENCES

1. Yun MJ, Kim YH, Han MK, Kim JH, Hwang JW, Do SH. Analgesia before a spinal block for femoral neck fracture: fascia iliaca compartment block. *Acta Anaesthesiol Scand* 2009;53:1282-7.
2. Lamaroon A, Raksakietisak M, Halilamien P, Hongswad J, Kwankamol, Boonsararuxsapong. Femoral nerve block versus fentanyl: Analgesia for positioning patients with fractured femur. *Local Reg Anesth* 2010;3:21-26.
3. Haines L, Dickman E, Ayvazyan S, Pearl M, Wu S, Rosenblum D, et al. Ultrasound guided fascia iliaca compartment block for hip fractures in the emergency department. *Emerg Med J* 2012;43:692-7
4. Casati A, Baciarello M, DiCianni S, Danelli G, Marco D, Leone S et al. Effects of ultrasound guidance on the minimum effective anaesthetic volume required to block the femoral nerve. *Br J Anaesth* 2007;98:823-7.
5. Foss NB, Kristensen BB, Bundgaard M, Bak M, Heiring C, Virkelyst C et al. Fascia iliaca compartment blockade for acute pain control in hip fracture patients: a randomized, placebo-controlled trial. *Anesthesiology* 2007;106:773-8.
6. Bunting LV, Calvello EJB. Ultrasound guided nerve blocks. [online] Available from: <http://www.sonoguide.com/femoral-nerve-block> (accessed 5 march 2014).
7. Christosis SC, Chiampas G, Offman R, Rifenburg R. Ultrasound guided three in one nerve blocks for femur fractures. *West J Emerg Med* 2010;11:310-3
8. Dolen J, Williams A, Murney E, Smith M, Kenny GNC. Ultrasound guided fascia iliaca block: A comparison with loss of resistance technique. *Reg Anesth Pain Med* 2008;33:526-31.
9. Capdevila X, Biboulet PH, Bouregba M, Barthelet Y, Rubenovitch J, d'Athis F. Comparison of the Three-in-One and Fascia Iliaca Compartment Blocks in Adults: Clinical and Radiographic Analysis. *Anesth Analg* 1998;86:1039-44
10. Wallace LTJB, Andrade LTJA, Christensen LCDR JP, Osborne CDR LA, Pellergrini JE. Comparison of fascia iliaca compartment block and three in one block in adults undergoing knee arthroscopy and meniscal repair. *AANA J* 2012;80:37-44.