Comparison of efficacy of magnesium sulphate and dexamethasone as adjuvants to ropivacaine in ultrasound guided Suprainguinal fascia Iliaca block administered before regional Anesthesia for patients undergoing proximal femur fracture surgeries

Dr. Santoshilaxmi CD and Dr. Srinivas Kakhandki

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Abstract
Background and Aim: Fascia iliaca compartment block (FICB) provides excellent analgesia to patients with proximal femur fractures, especially required during positioning to regional anesthesia. Use of ultrasonography (USG) helps in direct visualisation of the anatomy and with suprainguinal approach single injection of drugs administered. We compared the efficacy of Magnesium sulphate (MgSO4) and Dexamethasone as additives to 0.2% ropivacaine for FICB for better pain relief and post op analgesia.

Methods: This is a comparative, randomised, double blind, controlled prospective study included 50 patients with 18-90 years of age group, belonging to ASA I to III, undergoing proximal femur fracture surgeries. Patients were divided into two groups of 25 each. Group M (magnesium sulphate) patients received 0.2% ropivacaine 28ml with 2ml of 25% MgSO4 (500mg). Group D(dexamethasone) patients received 0.2% ropivacaine 28ml with 2ml of dexamethasone (8mg) for USG guided FICB. Time for onset of analgesia using numerical rating scale (NRS <5), time for complete analgesia (NRS is 0) on passive movement of the limb, duration of post op analgesia, patient satisfaction, ease of positioning were assessed for first 24 hrs. Descriptive and inferential statistical analysis has been carried out in the present study. Student t test has been used for quantitative data analysis. Chi square test/ Fisher Exact test has been used for qualitative data analysis.

Results: Time for onset of analgesia (NRS <5) was decreased with MgSO4 (P value < 0.001). Time for complete analgesia (NRS 0) was also decreased with MgSO4 (P value < 0.001). Post op analgesia was more with Dexamethasone group (P< 0.001). Patient satisfaction, and ease of positioning was good in both the groups.

Conclusion: Addition of MgSO4 and Dexamethasone to Ropivacaine for FICB provides better analgesia coverage with MgSO4 reducing onset of analgesia and time for complete analgesia. Dexamethasone provides increased duration of analgesia.

Keywords: Suprainguinal fascia Iliaca compartment block, ropivacaine, magnesium sulphate, dexamethasone, positioning for spinal Anesthesia

Introduction
Proximal femur fractures are associated with a considerable amount of pain. Severe pain increases the risk of delirium, depression, sleep disturbance and also adds to increased morbidity and mortality in all age groups [1]. So interventions to alleviate pain should be started early. Extreme pain associated with these fractures poses great challenge for positioning during regional anesthesia for corrective surgeries.

Peripheral nerve blocks are more effective with less adverse effects and provide better analgesia. The fascia iliaca compartment block (FICB) was initially described by Dalen’s et al² on children using landmark technique, later it was described in adults. This block is useful pre and post operatively for fractures of the hip and proximal femur as well as total hip arthroplasties to provide analgesia and anesthesia. Use of ultrasound helps in identification of the fascial planes which may lead to faster onset, denser nerve block and increased rate of successful blocks. In suprainguinal approach to fascia iliaca, local anesthetic is injected superficial to the iliacus muscle, superior to the inguinal ligament. This will block both the femoral and lateral cutaneous femoral nerve completely.

Corresponding Author:
Dr. Santoshilaxmi CD
Assistant Professor,
Department of Anesthesiology,
MR Medical College, BTGH,
Sedam Road, Kalaburagi,
Karnataka, India

Dr. Santoshilaxmi CD and Dr. Srinivas Kakhandki

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This is because femoral and lateral cutaneous femoral nerve are not branched off and have consistent course at this location [3]. Various studies have been done on fascia iliaca block using either bupivacaine/ ropivacaine with or without adjuvants. Few studies have compared lesser doses of magnesium sulphate and dexamethasone and found increased onset of action with lesser duration of post op analgesia. So, in this study we have compared slightly higher dosages of MgSO4 & dexamethasone with ropivacaine to further reduce the onset of action, prolong the duration of post operative analgesia and reduce the requirement of rescue analgesics.

Methods
After obtaining Institutional ethics committee approval , a prospective controlled randomized double blind study was conducted in 50 patients in the age group of 18-90 yrs, belonging to ASA I,II, III who were posted for elective proximal femur fracture surgeries. Exclusion criteria included patients refusal, ASA IV and above, contraindications to regional anesthesia, psychiatric illness, allergic to local anesthetics, peripheral neuropathy, patients on anticoagulants. The anesthetist performing the block was not blinded to the procedure, but the patient and assessor of numerical rating scale (NRS) were blinded to the group allocation. Informed and written consent was obtained and patients were divided into two groups of 25 each by systematic random sampling. Pre anesthetic check up performed previous day. Investigations reviewed. Patients were selected accordingly and prepared. After shifting to operation theatre,18G iv cannula secured and crystalloid, for entire length and tip of the needle seen. Racial scale was used to assess the simplicity and reliability for homogeneity of variance has been performed to assess the homogeneity of variance. The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Student test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven’s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Non-parametric setting for Qualitative data analysis. Fisher Exact test used when cell samples are very small.

+ Suggestive significance (P value: 0.05<P< 0.10)
* Moderately significant (P value:0.01<P≤ 0.05)
** Strongly significant (P value: P≤ 0.01)

Fig 1: courtesy: PNB school.com/ultrasound guided nerve blocks

Statistical Analysis
The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Student test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven’s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Non-parametric setting for Qualitative data analysis. Fisher Exact test used when cell samples are very small.

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Results
Demographic characteristics were comparable in both the groups (table 1). Block timing, block procedure, surgical timing were comparable in both the groups. Onset of analgesia was significantly lower in group M compared to group D. In group M complete analgesia achieved was significantly early than group D. post op analgesia was significantly longer in group M compared to group D (table 2, graph 1, graph 2, graph 3). Vitals were stable in both groups. Patients were satisfied with block, and no major complications noted.

Table 1: Demographic characteristics, spinal dose, duration of surgery

|                          | Group M | Group D | P value |
|--------------------------|---------|---------|---------|
| Age in years             | 52.56±9.12 | 55.76±9.56 | 0.232   |
| Gender (F/M)             | 10/15   | 9/16    | 0.77    |
| Approximate Height in cm | 158.68±3.70 | 159.28±3.52 | 0.56    |
| ASA grade (I/II/III)     | 3/20/2  | 7/16/2  | 0.36    |
| Spinal dose in ml        | 2.70±0.27 | 2.74±0.22 | 0.57    |
| Duration of surgery in hours | 3.10±0.19 | 3.24±0.24 | 0.027   |

Table 2: block characteristics

|                          | Group M | Group D | P value |
|--------------------------|---------|---------|---------|
| Onset of analgesia NRS <5 | 2.48±0.51 min | 4.64±0.57 min | <0.001 significant |
| Complete analgesia NRS 0  | 4.88±0.83 min | 7.80±1.00 min | <0.001 significant |
| Post op analgesia        | 16.38±0.39 hrs | 17.56±0.44 hrs | <0.001 significant |

Table 2: block characteristics

Discussion
Positioning for successful regional anesthesia in patients with hip and proximal femur fracture for corrective surgeries is a major challenge. Kacha NJ, et al. [11] concluded that FICB effectively provides analgesia for positioning for spinal anesthesia with good postoperative analgesia without altering the hemodynamic profiles of patients. The analgesic effect of fascia iliaca compartment block was superior to that of opioids during movement, resulted in lower preoperative analgesia consumption and a longer time for first request, and reduced time to perform spinal anaesthesia. Block success rate was high and there were very few adverse effects [10]. A systematic review from 2011 concluded that regional nerve blockades, including fascia iliaca, seemed to be effective in reducing pain and decreased the incidence of delirium in patients with hip fractures [7]. In a study by Monzon et al. [8], there was marked decrease in pain scores from 8.5 to an average of 2.3 on a 10 point pain scale. Stevens et al. [9], found significantly less morphine consumption over 24 hrs period compared to control groups. USG helps in direct visualization of the structures and avoids complications. Suprainguinal approach is simple, completed with single injection technique. P. Hebbard et al. [10], did study on cadaveric patients injecting 20 ml of 0.25% of aniline dye into fascia iliaca using USG guided suprainguinal approach. They concluded with low volume they could see the good spread of the dye around femoral and LFCN.

Ropivacaine, the S-enantiomer of 1-propyl-2', 6'-ppecoloxylidide, the most commonly used long-acting local anesthetics in the peripheral nerve blockade. it has reduced central nervous system and cardiac toxicity. Due to the lower lipid solubility produces less motor blockade and more sensory blockade [11-13]. Anupreet et al. [14], also concluded that the onset of action of sensory and motor block was early in ropivacaine group with faster recovery of motor functions as compared to bupivacaine group. hence we also chose ropivacaine due to its less toxicity especially in elderly patients.

Magnesium sulphate has an analgesic effect when given through i.v, intrathecal, epidural or intra articular routes. It exerts its anti nociceptive effects via its antagonistic action on Ca²⁺ channel and its inhibitory effects on NMDA receptors. Another theory which is proposed for its action is 'surface charge theory'. Mg²⁺ being a cation neutralises the anionic external neural membrane making the cell surface closer to neutral.
hyperpolarised and difficult to stimulate which explains its early onset of nerve block. [115] Hala E.A Eid et al. [115], did comparative study with 0.25% bupivacaine 30 ml without and with 250 mg of MgSO4 as additive in FICB, before spinal anesthesia. MgSO4 significantly prolonged the duration of analgesia (7.6±1.2 hrs) decreasing opioid demand without side effects. Hessam A. Elshamaa et al. [16], compared 20 ml of 0.25% bupivacaine with 5ml of 10% MgSO4(500mg) with plain bupivacaine for femoral nerve block using nerve stimulator, in patients of varicose veins of lower limb for LASER photoocoagulation. They concluded that addition of MgSO4 profoundly prolonged the duration of sensory and motor block with significant decrease in pain scores and total dose of rescue analgesia. In our study, group M patients showed early onset of analgesia 2.48±0.51 min with post op analgesia of 16.38±0.39 hrs. which was very significant compared to previous studies. Studies have found that dexamethasone significantly prolonged the duration of ropivacaine and bupivacaine when used for the interscalene block. [17] Steroids induce degree of vasoconstriction and act by reducing local anesthetic absorption, they also increase the activity of inhibitory K’channels on nociceptive C fibres, thus decreasing their activity and modifying the membrane lipid phase equilibrium. [18]

Suresh Kumar N et al. [19], added 8mg dexamethasone to 38ml of 0.25% bupivacaine for FICB in patients with fracture femur before undergoing SAB. They concluded comfortable positioning for SAB and prolonged post op analgesia of 16.33±5.69 hrs. Ranjitha Acharya et al. [20], compared 4mg and 8mg dexamethasone with 0.5% levobupivacaine making it to total volume of 30ml for FICB in patients with proximal femur fracture undergoing surgery under spinal anesthesia. They found prolonged duration of post op analgesia of 17.02 ± 0.45 h with 8mg dexamethasone. In our study for group D patients we used 28ml of 0.2% ropivacaine with 8mg dexamethasone. Duration of post op analgesia was 17.56±0.44 hrs which was very much significant (P< 0.001).

Conclusion
we conclude, Magnesium sulphate and Dexamethasone in a dose used in our study, are very effective as additives to ropivacaine for FICB. Magnesium sulphate reduces time of onset of analgesia and dexamethasone prolongs the duration of analgesia, with both drugs showing no noted adverse effects, with satisfactory patients response.

Conflicts of Interest: NIL.

References
1. Nirav Jentilal Kacha, Chetna A Jadeja, Pooja J Patel, et al. Comparative Study for Evaluating Efficacy of Fascia Iliaca Compartment Block for Allieving Pain of Positioning for Spinal Anaesthesia in Patients with Hip and Proximal Femur Fractures, Indian Journal of Orthopaedics, 2018, 52(2).
2. Dalens B, Vanneuville G, Tanguy A. Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg. 1989; 69(6):705-713.
3. Hironobu Ueshima, Hiroshi Otake. Supra-inguinal fascia iliaca block under ultrasound guidance for perioperative analgesia during bipolar hip arthroplasty in a patient with severe cardiovascular compromise. Medicine (Baltimore). 2018; 97(40):e12746.
4. Bendinger T, Plunkett N. Measurement in pain medicine. BJA Education. 2016; 16(9):310-315.
5. Admir Hadzic, Hadzic’s textbook of regional anesthesia and acute pain management. Edn 1,Mc Graw-Hill Education, New York, 2017; 2:602-603.
6. Steenber J, Moller AM. Systematic review of the effects of fascia iliaca compartment block on hip fracture patients before operation. Br J Anaesth. 2018; 120(6):1368-1380.
7. Abou-Setta AM, Beaupre LA, Rashiq S et al. Comparative effectiveness of pain management interventions for hip fracture: a systematic review. Ann Int Med. 2011; 155:234-45.
8. Godoy Monzon D, Iserson KV, Vazquez JA. Single fascia iliaca compartment block for post-hip fracture pain relief. J Emerg Med. 2007; 32(3):257-62.
9. Stevens M, Harrison G, McGrail M. A modified fascia iliaca compartment block has significant morphine-sparing effect after total hip arthroplasty. Anaesthesia Intensive Care, 2007; 35(6):949-52.
10. Heppard P, Ivanusic J, Sha S et al. Ultrasound-guided supra-inguinal fascia iliaca block: A cadaveric evaluation of a novel approach. Anaesthesia. 2011; 66:300-305.
11. McClure JH. Ropivacaine. Br J Anaesth. 1996; 76:300-7.
12. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian J Anaesth 2011; 55:104-10.
13. Stoelting RK, Flood P, Rathmell JP et al. Stoelting’s Pharmacology and Physiology in Anesthetic Practice. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2015, 282-313.
14. Kaur A, Singh RB, Tripathi RK, Chouhey S. Comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries under axillary brachial plexus block: A prospective randomized study. J Clin Diagn Res. 2015; 9:UC01-6.
15. Hala EA, Eid, Mohamed A, Shafie et al. Magnesium prolongs the duration of analgesia after a bupivacaine fascia iliaca compartment block. Ain-Shams Journal of Anesthesiology. 2012; 5:233-237.
16. Hessam A. ELShamaa, Mohamed Ibrahim et al. Magnesium sulfate in femoral nerve block, does postoperative analgesia differ? A comparative Study. Egyptian Journal of Anaesthesia. 2014; 30:169-17.
17. Cummings KC 3rd, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth. 2011; 107:446-53.
18. Attardi B, Takimoto K, Gealy R, Severns C, Levitan ES. Glucocorticoid induced up-regulation of a pituitary K+ channel mRNA in vitro and in vivo. Receptors Channels. 1993; 1:287-93.
19. Suresh Kumar N, Kiran N, Ravi M et al. Dexamethasone as An Additive to Bupivacaine in Fascia iliaca Compartment Block: A Prospective, Randomized and Double Blind Study. Journal of Clinical and Diagnostic Research. 2014; 8(8):GC05-GC08.
20. Ranjita Acharya, Bhavna Sriramka, et al. Comparison of 4 mg dexamethasone versus 8 mg dexamethasone as an adjuvant to levobupivacaine in fascia iliaca block- A prospective study. Korean J pain. 2018; 31(4):261-267.