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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

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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 al*² 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.

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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 operative 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 started. Minimum mandatory monitors like pulse oximeter, NIBP, ECG, SpO2 attached and basal parameters recorded. Preoperative pain scale noted using numerical rating scale. Numeric rating scale (NRS) is most commonly used to assess the present intensity of acute pain. The NRS for pain is a unidimensional measure of pain intensity in adults. The NRS, using an 11-point scale (0-‘no pain’ to 10-‘worst pain’, or ‘pain as bad as it could be’), is often preferred due to its administration simplicity and reliability⁴. The anesthetist performing the block was not blinded to the procedure, but the patient and assessor of pain NRS (numerical rating scale) were blinded to group allocation. Block was performed with Sonosite micromax ultrasound machine with linear high frequency probe (13-6 MHz).

Fascia iliaca compartment block is considered alternative to femoral nerve or lumbar plexus block. Femoral and lateral femoral cutaneous nerve (LFCN) lie under the fascia of the iliacus muscle. The local anesthetic injected underneath the fascia will spread around and block these nerves⁵. In USG guided suprainguinal FICB, With patient in supine position area to be blocked painted with 2% chlorhexidine and sterile draping put. sterile gel and Sterile sheath placed over the probe. Inj 2% lignocaine with adrenaline local anesthetic is injected at the site of block. linear transducer is placed in inguinal crease vertically with the marker facing cephalad and positioned near anterior superior iliac spine, oriented midway between umbilicus and xyphisternum. Probe is moved along inguinal ligament from lateral to medial side until an hour glass (bow –tie) pattern formed by sartorius and internal oblique muscle is found, (fig 1). Just below this is fascia iliaca encircling iliacus muscle. With 23 G, 100

mm quincke s spinal needle skin, subcutaneous tissue, sartorius muscle and fascia iliaca pierced. A single pop felt. Under USG entire length and tip of the needle seen. Study drugs administered below the fascia. Separation of iliacus muscle from fascia is clearly seen with the deposition of the drugs.

for Group M inj. 0.2% ropivacaine 28ml with 2ml of 25% MgSo4 (total 500mg) administered, for group D inj. 0.2% ropivacaine 28ml with 2ml of dexamethasone (8mg) administered, making the total volume of 30ml. After the completion of the block, subjective pain assessment, vitals recorded every minute. Time duration once the subjective pain score is NRS <5, is taken as onset of analgesia. Time duration when patient feels no pain on passive movement, NRS 0 is taken as complete analgesia. Then patient is positioned with support for spinal anesthesia. inj. Bupivacaine 0.5% (H) administered. Intra op vital parameters monitored. Total duration of analgesia, patient satisfaction, ease of positioning, complications were assessed for first 24 hrs. when patient feels pain NRS >5, rescue analgesic inj. Tramadol 50mg iv administered.



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 \pm 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: $0.01 < P \leq 0.05$)

** Strongly significant (P value: $P \leq 0.01$)

Results

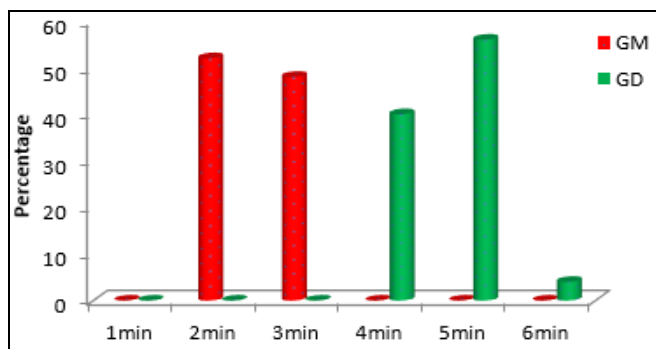
Demographic characteristics were comparable in both the groups (table 1). Block timing, block procedure, surgical timing were comparable in both the groups. Onset of analgesia was significantly lower in group M compared to group D. In group M complete analgesia achieved was significantly early than group 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

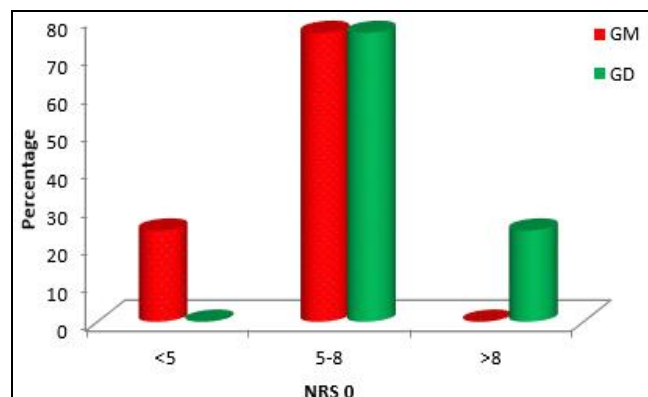
	Group M	Group D	P value
Age in years	52.56±9.12	55.76±9.56	0.232
Gender (F/M)	10/15	9/16	0.77
Approximate Height in cm	158.68±3.70	159.28±3.52	0.56
ASA grade (I/II/III)	3/20/2	7/16/2	0.36
Spinal dose in ml	2.70±0.27	2.74±0.22	0.57
Duration of surgery in hours	3.10±0.19	3.24±0.24	0.027

Table 2: block characteristics

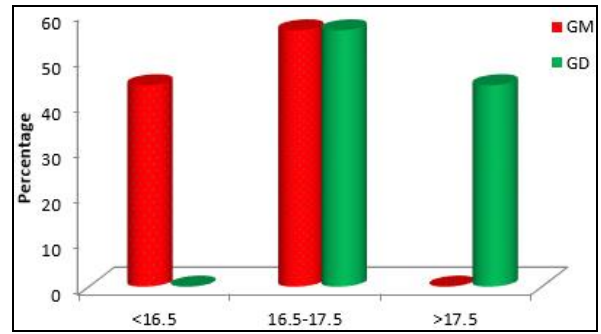
	Group M	Group D	P value
Onset of analgesia NRS <5	2.48±0.51 min	4.64±0.57 min	<0.001 significant
Complete analgesia NRS 0	4.88±0.83 min	7.80±1.00 min	<0.001 significant
Post op analgesia	16.38±0.39 hrs	17.56±0.44 hrs	<0.001 significant



Graph 1: Subjective NRS score <5



Graph 2: Complete analgesia (minutes)



Graph 3: Post op analgesia (Hrs)

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.* [1] 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 [6]. 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'-pipercoloxylidide, 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 Ca⁺² channel and its inhibitory effects on NMDA receptors. Another theory which is proposed for its action is 'surface charge theory'. Mg⁺² being a cation neutralises the anionic external neural membrane making the cell surface

hyperpolarised and difficult to stimulate which explains its early onset of nerve block. ^[15] Hala E.A Eid *et al.* ^[15], 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. Hossam 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 photocoagulation. 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 block¹⁷. 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

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