"ULTRASOUND GUIDED PERICAPSULAR NERVE GROUP (PENG) BLOCK FOR HIP SURGERY. A RANDOMIZED CONTROLLED STUDY COMPARING ROPIVACAINE AND ROPIVACAINE WITH DEXAMETHASONE"

By

Dr. ASWIN B

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

Under the Guidance of

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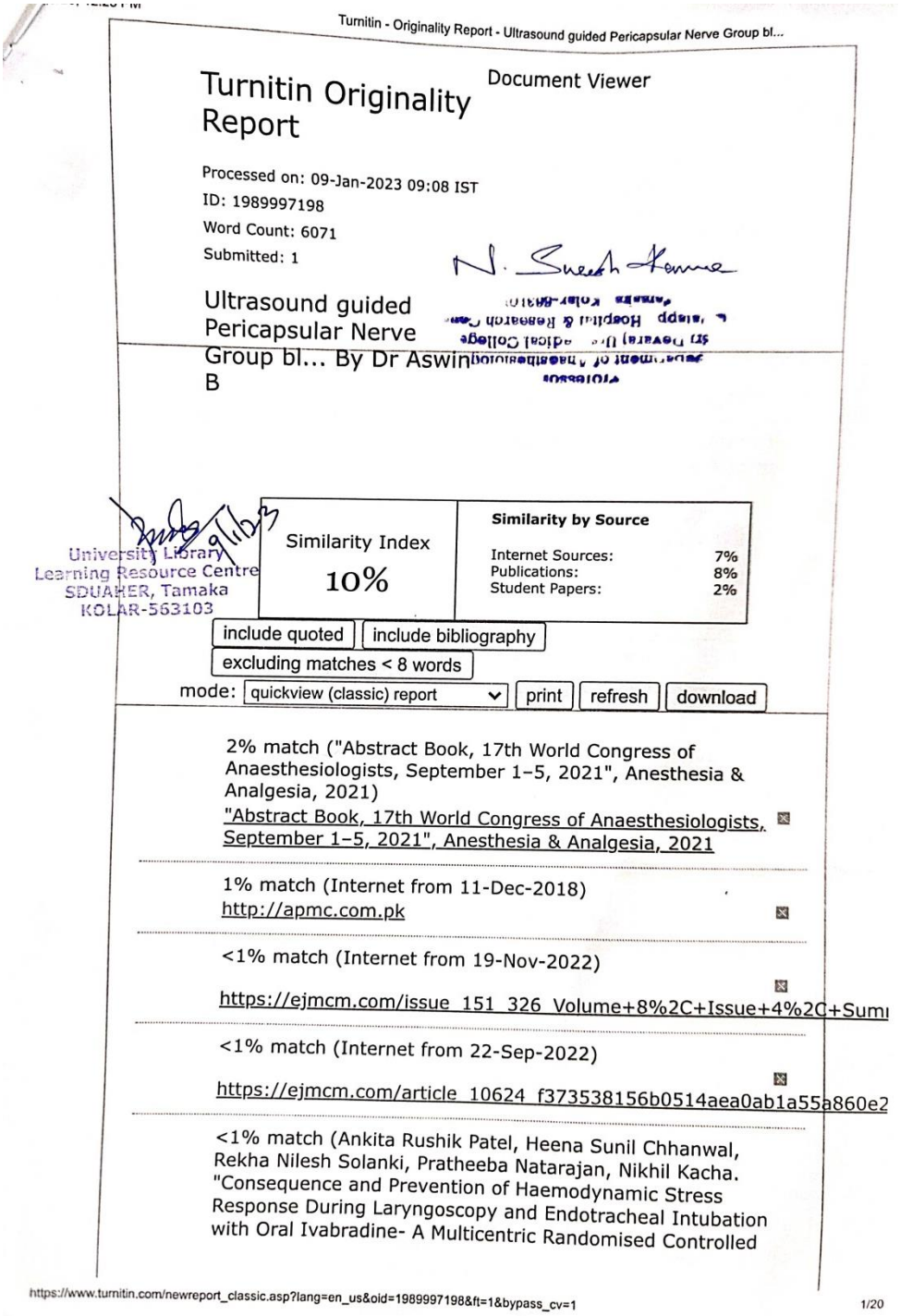

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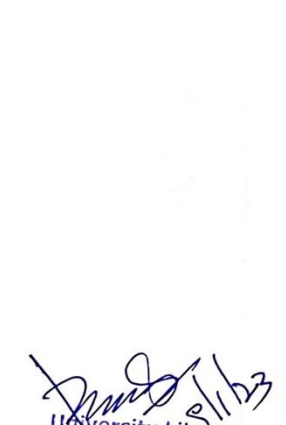

ABSTRACT

Background: Patients with hip fracture will be experiencing excruciating pain, which would prevent ideal positioning of the patient for the neuraxial blockade. Patients with hip fracture will be experiencing excruciating pain, which would prevent ideal positioning of the patient for neuraxial blockade. Femoral nerve (FN) block, Fascia Iliaca Block (FIB), 3-in-1 block not only provides perioperative analgesia but also reduced the opioid requirement in such a patients.

Objectives: To check the effectiveness of PENG block using ropivacaine alone and ropivacaine with dexamethasone with help of Pain score for patient positioning during neuraxial blockade and to compare the duration of post-surgical analgesia

Material & Method: This randomized controlled study was conducted among 28 patients posted for hip surgery for hip fracture under spinal anaesthesia at tertiary care referral hospital between January 2021 and May 2022. 28 patients (14 in each group) were randomly allocated to either group A (20 ml of 0.5% ropivacaine for PENG block) or Group B (20ml of 0.5% ropivacaine with 8mg Dexamethasone for PENG block). Intra-operative hemodynamic variables, pain score on VAS at baseline at rest and movement, pain score on VAS at the time of positioning for neuraxial blockage, time for first rescue analgesic request and total dosage of rescue analgesia in first 24 hours after PENG block were measured

Results: Pain score on VAS in rest and movement at baseline and at the time of positioning for neuraxial blockage. Time for first rescue analgesic requirement was significantly longer duration in group B (445.0 ±17.4) compared to group A patients (388.9±19.0) (p<0.05) .Similarly the mean dose of rescue analgesia was significantly lower in group B (1.9±0.6) compared to group A patients

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Date: **Dr ASWIN B**

Place: Kolar

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ABBREVIATIONS

AIIS	ANTERIOR INFERIOR ILIAC SPINE
CNS	CENTRAL NERVOUS SYSTEM
CYP	CYTOCHROME
FIB	FASCIA ILIAC BLOCK
FN	FEMORAL NERVE
IPE	ILIOPUBIC EMINENCE
L	LUMBAR
LA	LOCAL ANAESTHSIA
LFCN	LATERAL FEMORAL CUTANEOUS NERVE BLOCK
PENG	PERICAPSULAR NERVE GROUP BLOCK
THA	TOTAL HIP ARTHROPLASTY
VAS	VISUAL ANALOGUE SCALE
WHO	WORLD HEALTH ORGANISATION

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Background: Patients with hip fracture will be experiencing excruciating pain, which would prevent ideal positioning of the patient for the neuraxial blockade. Femoral nerve (FN) block, Fascia Iliaca Block (FIB), 3-in-1 block not only provides perioperative analgesia but also reduced the opioid requirement in such a patients.

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groups

Conclusion: Present study documented effectiveness of PENG for patient positioning during neuraxial blockade and addition of dexamethasone as adjunct to ropivacaine shows significant longer duration of postoperative analgesia with lower requirement of the rescue analgesia

INTRODUCTION

INTRODUCTION

Hip fractures are a common orthopaedic condition that causes major mortality and morbidity. As a final treatment, the majority of patients with fractured hips would undergo early reduction and surgical fixation.[1]

Central neuraxial blockade is the most common anaesthetic technique used for surgical procedure on the hip.[2]

Patients with hip fracture will be experiencing excruciating pain, which would prevent ideal positioning of the patient for neuraxial blockade.

"In the past Femoral nerve (FN) block, Fascia Iliaca Block (FIB) and 3-in-1 block were used for hip fracture. These blocks not only provided perioperative analgesia but also reduce the opioid requirement in post surgical period.[3,4] The anterior hip capsule is innervated by femoral nerve, obturator nerve, and accessory obturator nerve branches. Current evidence suggests that PENG block is more effective in blocking above mentioned nerves".

Till date no studies have been done comparing the effectiveness of Ropivacaine and Ropivacaine with Dexamethasone for PENG block. As a result, we performed research to establish the effectiveness of both ropivacaine and ropivacaine with dexamethasone for PENG block under ultrasound guidance.

Goal of this research was to determine impact of PENG block using ropivacaine alone and ropivacaine with dexamethasone with help of pain score for patient positioning during neuraxial blockade and to find length of pain control in postsurgical period.

OBJECTIVES

AIMS & OBJECTIVES

To check the effectiveness of PENG block using ropivacaine alone and ropivacaine with dexamethasone with help of Pain score for patient positioning during neuraxial blockade and to compare the duration of postoperative analgesia

REVIEW OF LITERATURE

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Majority orthopaedic procedures performed on elderly patients are hip and knee surgeries. Patients undergoing hip surgery are very diverse, including both young and elderly patients. Young patients with hip congenital hip dysplasia, athletic young adults, and fragile elderly patients with many medical conditions who sustain catastrophic injuries from falls undergo hip surgery. After a hip operation, between 7 and 28% of individuals experience persistent discomfort.[5] Patients undergoing total hip arthroplasties can benefit greatly from regional anaesthesia in addressing both pain management and rehabilitation. Different regional anaesthesia methods include "lumbar plexus block, femoral nerve block, fascia iliaca block, lateral femoral cutaneous nerve blocks and selective obturator nerve infiltration". Newer strategies like local infiltration and quadratus lumborum block are described through literature for pelvic fractures but, they need further research for approval as standard of care.[5,6]

"According to the newer research, articular branches of femoral and accessory obturator nerve supplies hip joint. Pericapsular nerve group block (PENG), a novel regional anaesthetic procedure which blocks above mentioned nerves."[7]

Femoral nerve block and lumbar plexus block can both be replaced with PENG block. Added advantage of PENG is preventing quadriceps weakness and early postoperative rehabilitation[5]

L Girón-Arango and colleagues explained the PENG block for localised analgesic approach to lessen discomfort post total hip replacements (THR) ,with added advantage of maintaining motor function. In their approach the anaesthetic drug is deposited in the fascial plain in between the superior pubic ramus & the psoas muscle.[7,8]

Patients undergoing surgery for hip fractures benefit more from PENG block on comparing with FIB during subarachnoid block with relation to analgesia for ideal positioning and patient satisfaction.[9]

This blockade was perfect for patients with hip fractures because it had a motor-sparing effect without weakening the quadriceps. It was technically simple to acquire images of the traction-immobilized patient.[10]

A PENG block combined with an LFCN block may well deliver trustworthy analgesia in THA patients in the postoperative period. It might be a viable substitute for more complex neuraxial and lumbar plexus blocks.[11]

In addition, Ropivacaine, a long-acting local anaesthetic has reduced neuro and cardiovascular toxicity additionally having a lower tendency to cause motor blockade than bupivacaine.[12] Hence , we intended to study effectiveness of PENG block with ropivacaine and ropivacaine with dexamethasone for patient positioning prior to neuraxial block.

Anatomical consideration[5]

"By blocking articular branches of femoral nerve and the accessory and primary obturator nerves, the PENG block appears to be supra-inguinal equivalent of FIB."

The anterior and posterior femoral divisions of femoral nerve, which supply motor (innervating hip flexors and knee's extensors) and sensory branches, are divided by iliacus & psoas muscles. Femoral nerve is lumbar plexus's biggest branch originating from the 2^{nd} to 4^{th} lumbar spinal nerves. Before passing through the inguinal ligament, femoral nerve sends a motor branch to iliac.

Femoral nerve's articular branches for hip is given at a higher level. This is the reason for inability of femoral blocks, fascia iliaca compartment blocks are for relieving hip pain.

In certain individuals ventral rami of L2 to L4 give rise to the 'accessory obturator nerve' and frequently innervates the hip joint and adductor longus. It was discovered that the medial capsule is innervated by sensory fibres of accessory obturator nerve.[13,14]

Short along with his colleagues described that central sensory innervation of hip's anterior capsule is by high branches of the femoral and obturator nerves. Sensory innervation is absent in hip's posterior and inferior capsule.[15]

Potential sites for regional analgesia may be indicated by their anatomical passage through psoas major fibres, which helps in deposition of local anaesthetic drug for anaesthetizing these three nerves, providing analgesic coverage during hip surgery.[16]

Indications

Used for reducing pain following surgical repair of hip and hip bone fractures, in contrast to earlier peripheral blocks used for surgical treatment. It is typically used to treat pain following hip or thigh injuries or procedures. (e.g., head ,neck ,trochanteric inter and sub trochanteric fractures of femur)

Recent study showed how a PENG block may effectively numb a medial thigh lesion during surgery. [17]

The authors of prior research highlight the application of PENG block in vascular procedures like varicose vein stripping because the ligation and stripping sites were in dermatomes involving sensory supplies from obturator and femoral nerve .[18]

Sciatic nerve and sacral plexus include branches that innervate the posteromedial hip

capsule. PENG block cannot be sole anaesthetic technique employed during hip surgery.[19]

Contraindications

Infection at injection site, patient refusal, local anaesthesia allergy, coagulation disorders.

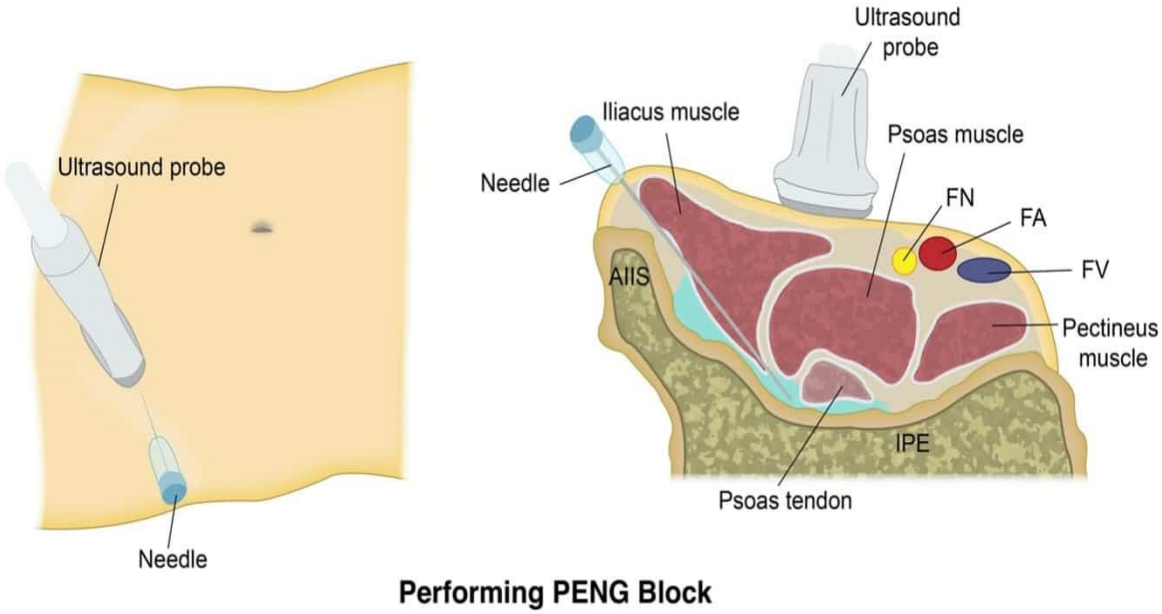

Figure 1: Diagrammatic representation of the Pericapsular Nerve Group block[20]

Preparation

A preoperative examination must be performed in accordance with WHO standards prior to the regional nerve block. Airway assessment, physical examination, medical history, and appropriate investigations should all be part of this evaluation. It is important to take note of the present course of therapy, which includes the use of analgesics and anticoagulants to reduce the risk of bleeding.

Figure 2: Standard nerve block tray (PENG block)[21]

The dangers and advantages of the PENG block should be explained. Before beginning the procedure, informed consent is required. Patient is positioned in supine after pre-procedure timeout. Slight abduction on operating lower limb is done. Use of mild to moderate sedation can be done. For skin preparation, use chlorhexidine gluconate 2% or 10% povidone-iodine. The linear ultrasonic curve probe is wrapped by a sterile ultrasonic probe cover.

Block is performed under strict aseptic precautions in a facility that has the necessary monitoring tools.

Types of Techniques:

In plane technique

"With patient supine, ultrasonic probe is positioned in a transverse plane above anterior superior iliac spine (ASIS). Once ASIS has been located, the transducer is positioned parallel to the inguinal crease. Moving the transducer medially along this axis allows the anterior inferior iliac spine (AIIS), iliopubic eminence (IPE), and psoas tendon to be easily delineated. Head of the femur is seen when sliding the ultrasonic probe distally or slightly tilting caudal. In the plane seen between psoas tendon and pubic ramus, a standard 22-23 gauge spinal needle is placed in-plane, moving lateral to medial. In this plane, 15-20 ml of local anesthetic (i.e., 0.5% ropivacaine) is injected to elevate the psoas tendon. Injury prevention for the psoas tendon is necessary".[21]

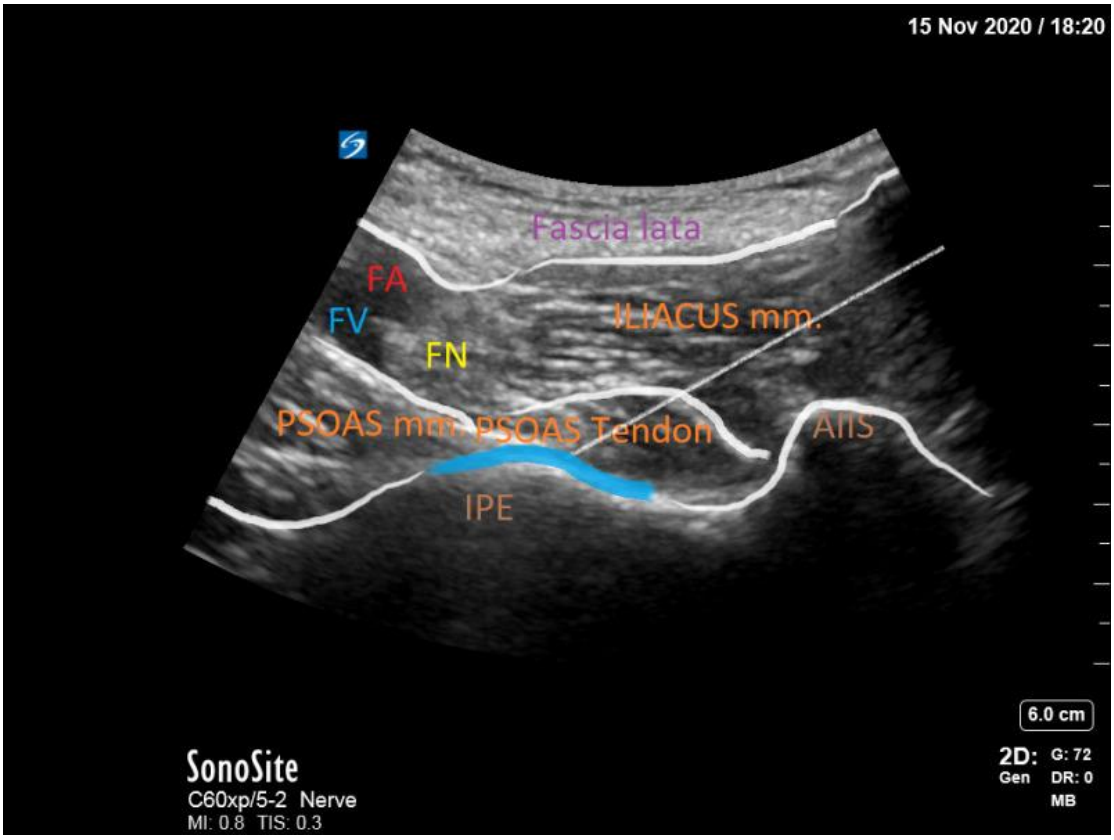

Figure 3: Sonoanatomy for PENG block[21]

(FA= femoral artery; FV = femoral vein; FN= femoral nerve AIIS = antero inferior iliac spine; IPE = iliopubic eminence.)

Out-of-plane technique: "Patient is positioned in supine posture with their hips extended after receiving enough premedication. Under strict asepsis, local anaesthetic infiltration done with 3 ml of LOX 2% at site of needle insertion using probe with low frequency. Just at level of anterior superior iliac spine (ASIS), probe is positioned parallel to inguinal fold, and scanning is performed by gently moving the probe head. Probe is slightly pushed medially to locate the psoas tendon, upper pubic ramus, and anterior inferior iliac spine. Advantage of this technique, it is easier to recognise the psoas muscle, which has prominent tendon that is located directly just above pubic ramus. The pubic ramus needs to be in the center of the image to precisely targeted within the AIIS. Through a 100 mm nerve block needle, 20 – 25 cc of a local anesthetic agent was administered beneath the psoas tendon".[22]

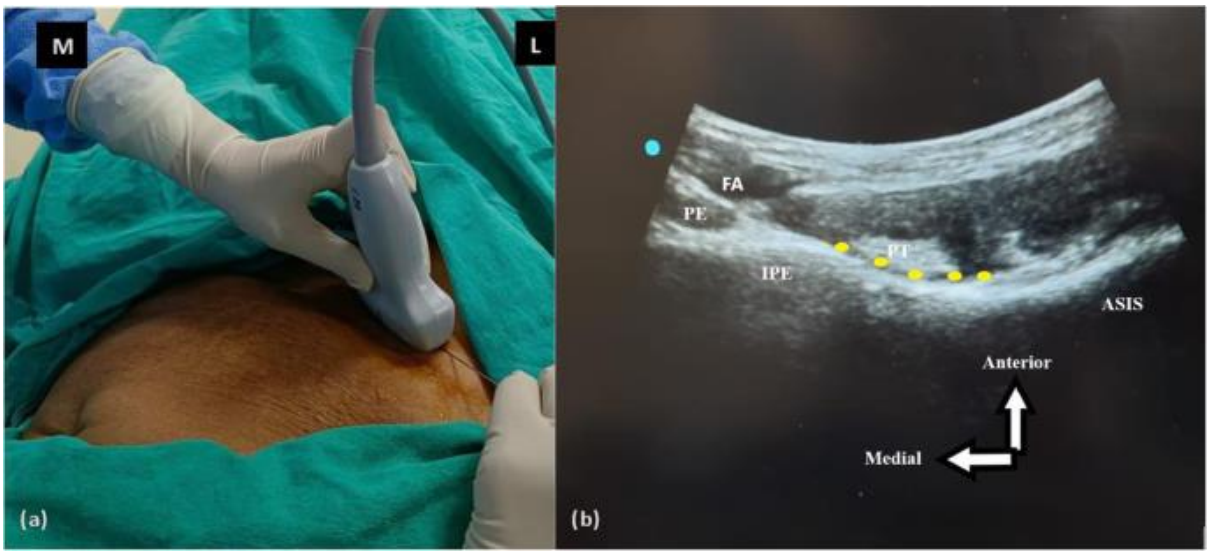

Figure 4: Ultrasound guided PENG block[23]

Complications

Techniques for regional anaesthesia necessitate in-depth familiarity with any potential risks associated with procedure. The risks of infection, haemorrhage, nerve injury, toxicity from local anaesthetics. Local anaesthesia systemic toxicity can occur with accidental intravascular injection or injecting dose that exceeds the toxic limits. In the event of LA toxicity immediate intravenous intralipid injection and hemodynamic support are taken instantly along with other supportive measures[24].

PHARMACOLOGY OF ROPIVACAINE[25]

Ropivacaine was initially produced as a pure enantiomer and is an amide local anaesthetic with a lengthy half-life. Due to its ability to reversibly suppress nerve fibres influxing of sodium ions similar to the effects of other local injectable anaesthetics agents. Ropivacaine having added advantage on bupivacaine ,as it enters big myelinated motor fibres ,which leads to reduced motor obstruction. As a result, when motor blocking is not desired, ropivacaine may be advantageous due to its higher degree of motor sensory discrimination.[26]

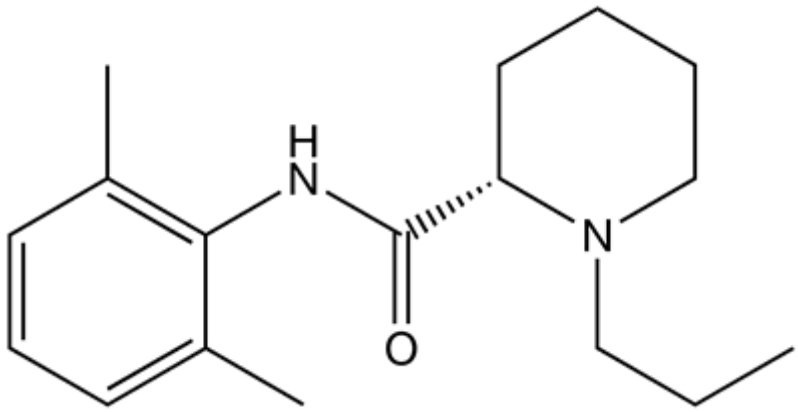

Figure 5: Chemical structure of Ropivacaine

Mechanism

Ropivacaine inhibits sodium ion inflow in a reversible manner, inhibiting nerve fibre impulse conduction.[26] Potassium channel suppression, which is dose-dependent, enhances this activity. It works just on the Aδ and C neurons that convey pain, avoiding the A fibres which involves motor activity.[27]

Pharmacodynamics

Less lipophilic and has stereoselective properties, which makes it less cardio and neuro toxic durg.[28] Significant alterations of cardiac functions which are observed are changes in contractility, increased conduction time.[29]

When concentrations are 3.75 mg/mL (i.e 0.375 %) & 1.88 mg/mL (0.188 percent), which are values that used during injection to the epidural space, ropivacaine have demonstrated to decrease platelet aggregation in plasma. [30] Similar to other local anaesthetics agent , ropivacaine has bacterial resistance, preventing growth of Pseudomonas aeruginosa, E.coli, Staphylococcus aureus.[31,32]

Pharmacokinetics

"The plasma concentration of ropivacaine is affected by total dose administered, the route of administration, patient's haemodynamic and circulatory status, and vascularity of administration site. When ropivacaine was given to patients intravenously, its pharmacokinetics were linear and dose proportional up to 80 mg.[33]The first phase has a mean half-life of about 14 minutes, followed by a slower phase with a mean absorption t1/2 of about 4.2 hours. During epidural injection for caesarean delivery, placental transfer of drug occurs, which leads appearance of free fraction of ropivacaine in maternal and also foetal circulation.[34,35,,]

Metabolism

Liver extensively metabolises ropivacaine by Cytochrome P450 (CYP) .86% of its excretion is through kidneys in the form of urine after the injection of one intravenous dosage.[33–35]

Toxicity

Unintentional intravascular ropivacaine injection appears to pose a modest risk of cardio and neuro toxicity. Suspected accidental IV ropivacaine injection was 0.2%, or six cases, based on a combined analysis of information from 3000 participants across 60 clinical studies. Convulsions only occurred in one patient, and there was no sign of cardiotoxicity

Clinical use

- Numerous clinical trials have indeed been carried out to evaluate the effectiveness of ropivacaine in treating postoperative pain, labour pain, surgical anaesthesia in adults and also children. Drug is frequently contrasted with bupivacaine or levobupivacaine. Numerous methods have been used to study the utility of ropivacaine in the treatment of chronic pain in recent years.
- Anaesthesia during Surgery
- Epidural administration
    - Lower abdomen surgery
- Peripheral nerve block
- Postoperative pain management
- Administrations via intrathecal

PHARMACOLOGY OF DEXAMETHASONE[37]

Philip Showalter Hench created dexamethasone a glucocorticoid , for the first time in 1957, and it was authorised for usage in 1958.[38]

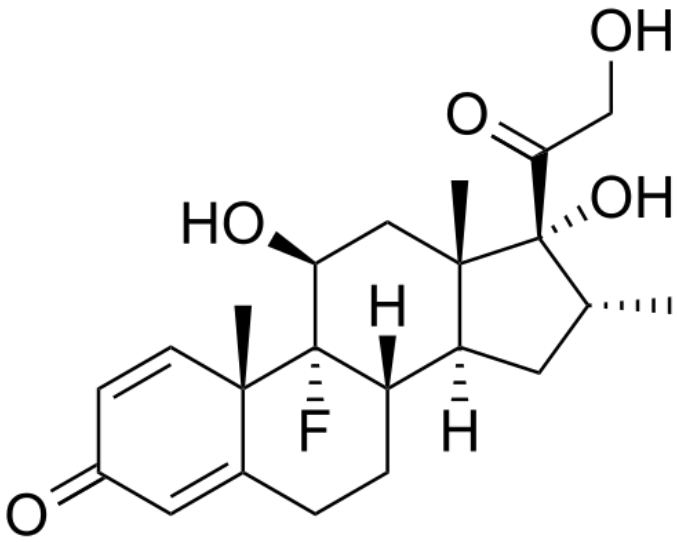

Figure 6: Chemical structure of Dexamethasone

Indications

Dexamethasone has demonstrated efficacy in management of acute exacerbations , multiple sclerosis, hypersensitivity reactions, cerebral edema, inflammatory processes, and shock. Dexamethasone has been proven to be beneficial for treating people suffering from conditions like asthma, atopic dermatitis, contact dermatitis, and adverse drug reactions. It has been successfully used to test Cushing syndrome in endocrinology.[39,40]

Dexamethasone is helpful in treating nausea and vomiting brought on by chemotherapy. Altitude sickness is also prevented and treated using it. Additionally, it has been used to relieve spinal cord compression brought on by metastases in cases of cancer.[41] Patients with COVID-19 who are critically sick and using supplementary oxygen or ventilator assistance are advised to take dexamethasone [42]

Mechanism of action

It is a potent glucocorticoid and has minimal to no mineralocorticoid activity.[43]. It restrict lymphocyte colony growth. Tumor necrosis factor, prostaglandin, interleukin-1,12,18 are all inhibited, along with greater blood concentrations of vitamin A compounds. It has also been shown that dexamethasone increases surfactant levels and improves pulmonary circulation. Dexamethasone is extensively metabolised by liver and substances are excreted via urine

Pharmacokinetics

Absorption: The average time from the highest concentrations (Tmax) for dexamethasone is one hr (average: 30 mins to 4 hours). A single Twenty milligram dosage of dexamethasone was reduced by 23% in C max by a high-fat, high-calorie meal.

Distribution: In vitro, dexamethasone is 77% attached to human serum proteins.

Elimination: Dexamethasone's average terminal half-life is approximately 4 hours

Metabolism: CYP3A4 metabolises dexamethasone.

Excretion: Less than 10% of the body's entire clearance of dexamethasone is eliminated by the kidneys. Dexamethasone excretion in urine is less than 10%.

Adverse effects

Dexamethasone has disadvantages as a drug even though it is often well tolerated. Insomnia following usage is the side effect that patients most commonly describe. Other frequent adverse effects include acne, irritability, sadness, gastritis, peripheral edema, electrolyte disturbances, excess weight, anorexia, and vomiting. Hepatotoxicity can occur in administrating high dosage. [44]

Contraindications

Patients who have dexamethasone hypersensitivity, systemic fungal infections, or cerebral malaria should not take dexamethasone.. Giving live or live-attenuated vaccinations while taking dexamethasone is another contraindication. The patient will have a weakened immune system, increasing their vulnerability to infection. Vaccines that have been destroyed or rendered inactive can still be administered. Nevertheless, it is important to note, because steroids can decrease the immune system's response, it is unclear whether immunity will develop as a result. [45,46]

REVIEW OF LITERATURE:

Meta-analysis was done by **Anwar-u-Huda and Hashsaam Ghafoor** included 6 RCT's. Their Results showed that PENG block use for hip surgery patients was associated with a significant drop in opioid use within the first 24 hours following surgery, better patient satisfaction and associated with lesser risk of motor block.[47]

Priyanka Krishnamurthy et al., did a comparative study on 40 patients who underwent surgical procedure for fracture hip. They compared USG guided FIB vs PENG block for post operative analgesia. The study concluded that, PENG block provide better analgesia for positioning for SAB and also provides comparable duration of postoperative analgesia without any complications.[48]

Fernicola MD et al., studied effectiveness of PENG block to attenuate perioperative pain on patients undergoing hip arthroscopy. Standard regional blockades frequently result in undesirable effects such as postoperative weakness in the lower limb and difficulty in movement. They concluded that, PENG block offers an effective and targeted sensory nerve block and minimal neuromuscular blockade when compared with conventional

regional anaesthetic techniques and also decreases postoperative opioid requirement.[49]

Celine Allard et al., compared the PENG block to the femoral block in 42 patients with a fractured femoral neck. The patients received one of the PENG block or the femoral block before the surgical procedure. They concluded that, there was not much change in postoperative morphine consumption between two groups. However, PENG block significantly improves the early mobility of the operated limb and thus would be valuable inclusion in enhanced recovery programe.[50]

G. Pascarella et al., studied the effects of PENG block in participants who undergone total hip replacement. 66 patients were studied and they concluded that there was significantly lesser post operative pain score in patients who received PENG block. Furthermore, there was a considerable decrease in opioid use, improved hip mobility, and a quicker recovery time to ambulate in patients who received PENG block.[51]

Craig Morrison et al., did a scoping review in the year 2020 using Framework of the Joanna Briggs Institute. They included the articles suggesting PENG block as either a method of regional anaesthesia technique or analgesia for hip discomfort. Ovid Medicine, Google Scholar, CINAHL, PubMed, Embase, and CINAHL were all searched. They included both adult and paediatric studies. Articles relating to non-orthopaedic indications, not in English, and not available in full text were eliminated.. They concluded that, the review was only of case studies and series. In addition, it was determined that PENG block is a viable method and an alternative for femoral nerve block or FIB.[52]

Swati Singh et al., published a case series of 10 patients who underwent surgery for hip fracture under SAB with a preoperative PENG block and continuous infusion of local anaesthetic via catheter placed during PENG block. They concluded that, none of the

patient required additional opioids . None of the patients developed complications like paraesthesia, quadriceps weakness, catheter migration and local anaesthetic toxicity.[53]

Micol Sandri etal., assessed the effectiveness of using local infiltration (LIA) as the sole anaesthetic method for hip replacement surgery in combination with PENG block**.** They studied efficacy of PENG and LIA in 10 patients with ASA 1 or 2 who underwent only direct anterior approach surgical technique. They used mixture of Levobupivacaine , ketorolac, epinephrine and morphine for LIA. They concluded PENG block plus LIA can be secure and effective anaesthesia method for THA using the direct anterior approach. This technique provides optimal anaesthesia and also better postoperative analgesia and decreased intraoperative blood loss.[54]

Laura Giron Arango et al., studiedefficacy of PENG block on 5 hip fracture patients after recent anatomical investigation on hip innervation led to discovery of pertinent sites to aim and block articular branches from femoral & accessory obturator nerve. They reported that patient , patients with hip fracture had severe hip pain both in rest and also with 15 degrees leg raise on the affected leg despite of opioid consumption. Whereas, after 30 minutes of block placement , all the patients had significantly reduced pain scores in rest and also with 15-degree leg raise. In addition, they did not appreciate any quadriceps weakness in all the 5 patients.[55]

K Knudsen et al., have compared CNS and CVS effects of ropivacaine and bupivacaine intravenously.They concluded that ropivacaine had increased unbound plasma levels and tolerable dosage compared to bupivacaine. Furthermore doses producing CNS symptoms, CVS effects like reduced diastolic performance and conduction are noticed in ropivacaine.[56]

METHODOLOGY

MATERIAL & METHOD

SOURCE OF DATA:

- Study Design: Parallel design randomized controlled trail
- Study Duration: From January 2021 to May 2022.
- Study Participants: This study was conducted on patients posted for hip surgery at R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar
- Sampling Method: Universal sampling. Randomization was done by software with 1:1 allocation using randomization with unequal block size

SAMPLE SIZE CALCULATION:

- Sample size estimated based on mean duration of difference in analgesia as reported in study "comparing 0.5% ropivacaine and 0.5% ropivacaine with magnesium sulphate in supraclavicular brachial plexus block for forelimb and hand surgeries"[5]

- To detect the difference of 30 mins of analgesia duration with 80% power with alpha error of 5% considering average variance estimate of (28.5), required sample size per group is estimated as 14 hip surgery cases satisfying inclusion and exclusion criteria.

FORMULA:

$$n = \frac{2[z_{\dot{\alpha}}+z_{1-\beta}]^2\ \sigma^2}{d^2}$$

Where , $\sigma_=$ standard deviation

d=precision

$\dot{\alpha}$ = Significance level

1-ß = Power

INCLUSION CRITERIA

"Patients over the age of 18 who have an American Society of Anaesthesiologists (ASA) physical status of 1-3 who are scheduled for hip fracture surgery under spinal anaesthesia".

EXCLUSION CRITERIA

- Refusing to take part in the study
- Allergy to local anaesthesia drugs
- Coagulation disorders-Increased Bleeding time and clotting time
- Infection at site of block
- Neurological deficits like paraplegia and paresis of lower limb and power less than 5/5

SAMPLING PROCEDURE :

- After receiving institutional ethical clearance, the study was started
- After receiving the patient's written, informed consent, the patient is enrolled in the study. The study involved adults older than 18 years old and requiring hip surgery.
- Routine investigations along with coagulation profile were done preoperatively
- Intravenous line was secured and IV fluids were connected.
- Patients are asked to rate the severity of pain according to VAS score after positioning the patient prior to PENG block and repeat the VAS score after positioning the patient for spinal anaesthesia half an hour after PENG block.
- Two groups of patients were created using a computer-generated random table.

- **Group A**: Receiving 20 cc of 0.5% ropivacaine in a PENG block.
- **Group B**: Receiving 20cc of 0.5% Ropivacaine with 8mg Dexamethasone in PENG block
- The patient received a subarachnoid block at the L3-L4 area while seated with 0.5% bupivacaine (H)3ml with 25micrograms of Fentanyl with 25G Quincke spinal needle with aseptic precautions.
- Heart rate, NIBP, SPO2 was monitored throughout the procedure and adverse effects if any were noted.

PARAMETERS OBSERVED

- Visual analog scale (VAS) score
- Heart rate
- Mean arterial pressure
- Oxygen saturation

STATISTICAL ANALYSIS

Data are gathered, coded and then added to an excel database. Qualitative measures, such as gender and ASA, and all the quantitative measurements were reported by (MeanSD), Confidence interval, and Measures of physical condition and CI. To evaluate the data, chi square tests, Mann- Whitney U-tests, and independent sample t-tests, exact Fisher's tests were deemed adequate. Statistics were considered significant if the P value was below 0.05.

RESULTS

RESULTS

In present study total of 28 patients included after obtaining the informed consent and distributed into two groups randomly as.

- **Group A**: Receiving 20 cc of 0.5% ropivacaine in a PENG block.
- **Group B**: Receiving 20cc of 0.5% Ropivacaine with 8mg Dexamethasone in PENG block

Table 1: Showing the age intervals and mean age of study participants

Age intervals	Number of patients
21 - 30 years	5
31- 40 years	4
41- 50 years	5
51- 60 years	7
61-70 years	3
71-80 years	1
81-90 years	3

	N	Minimum	Maximum	Mean	SD
Age in yr	28	21.0	85.0	51.00	18.60

The mean age of participants in the present study was found to be 51±18.6yrs with minimum age of 21yrs and maximum age of 85yrs.

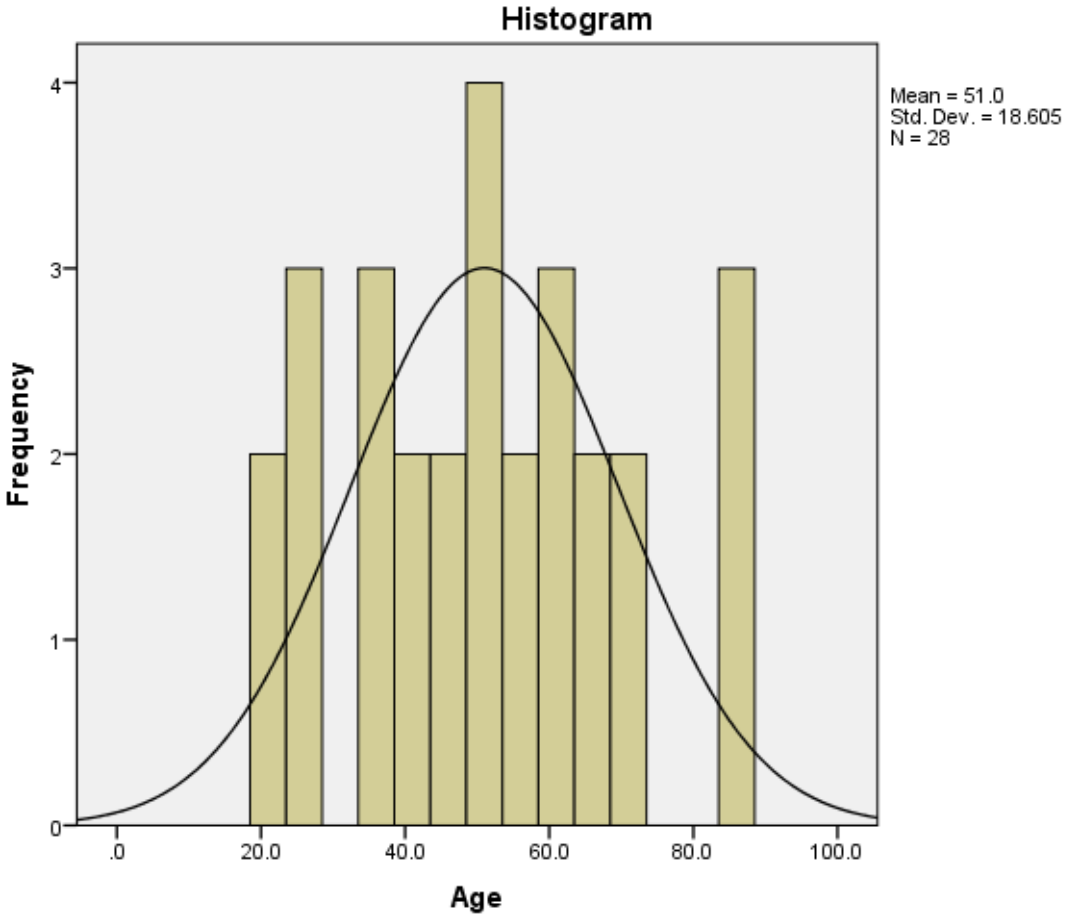

Figure 7: : Showing the mean age of study participants

Table 2: Showing the gender distribution of the patients in the study

		Frequency	Percent
Gender	Female	8	28.6
	Male	20	71.4
	Total	28	100.0

Gender wise, the male preponderance was noted with 71.4% male patients and 28.6% were female patients.

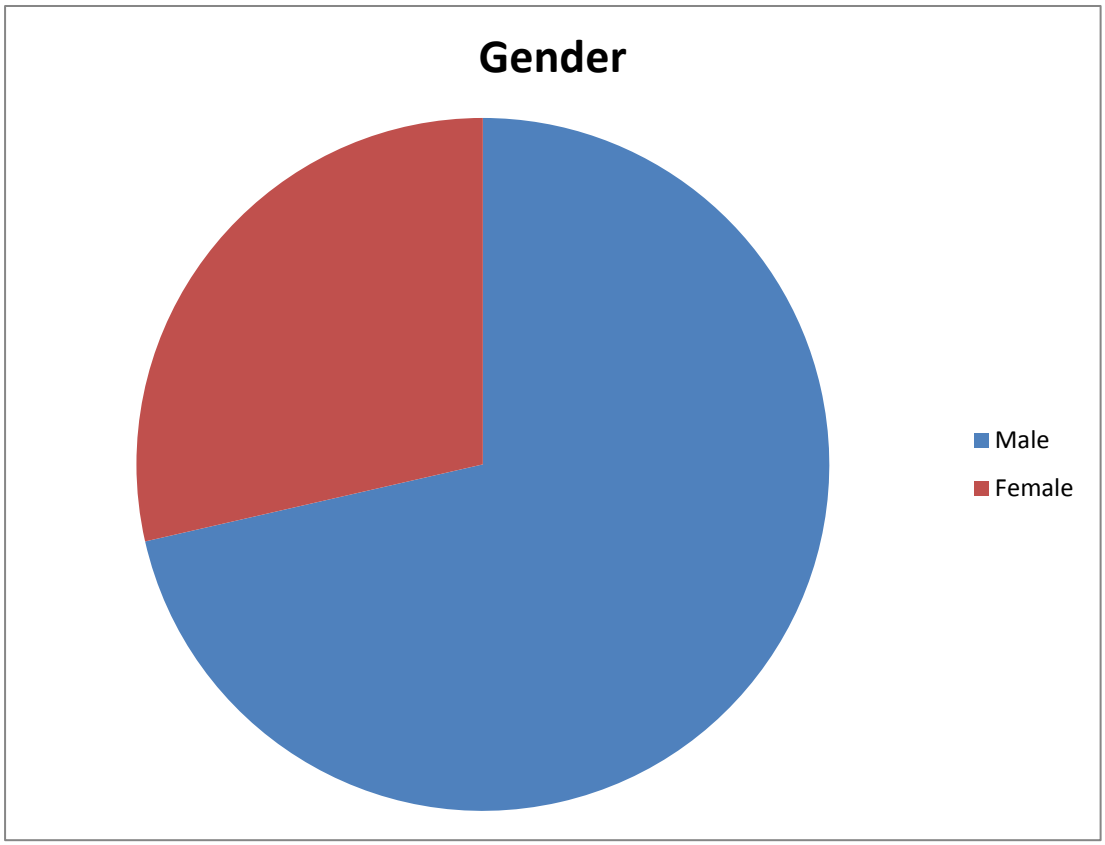

Figure 8:Showing the gender distribution of the patients in the study

Table 3: Comparison of the mean age and weight between the groups

	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Age	54.8	14.2	47.2	22.0	0.654
Weight	65.9	7.9	63.5	13.1	0.264

On comparison of the mean age and weight, there is no significant difference noted between the two group of patients.

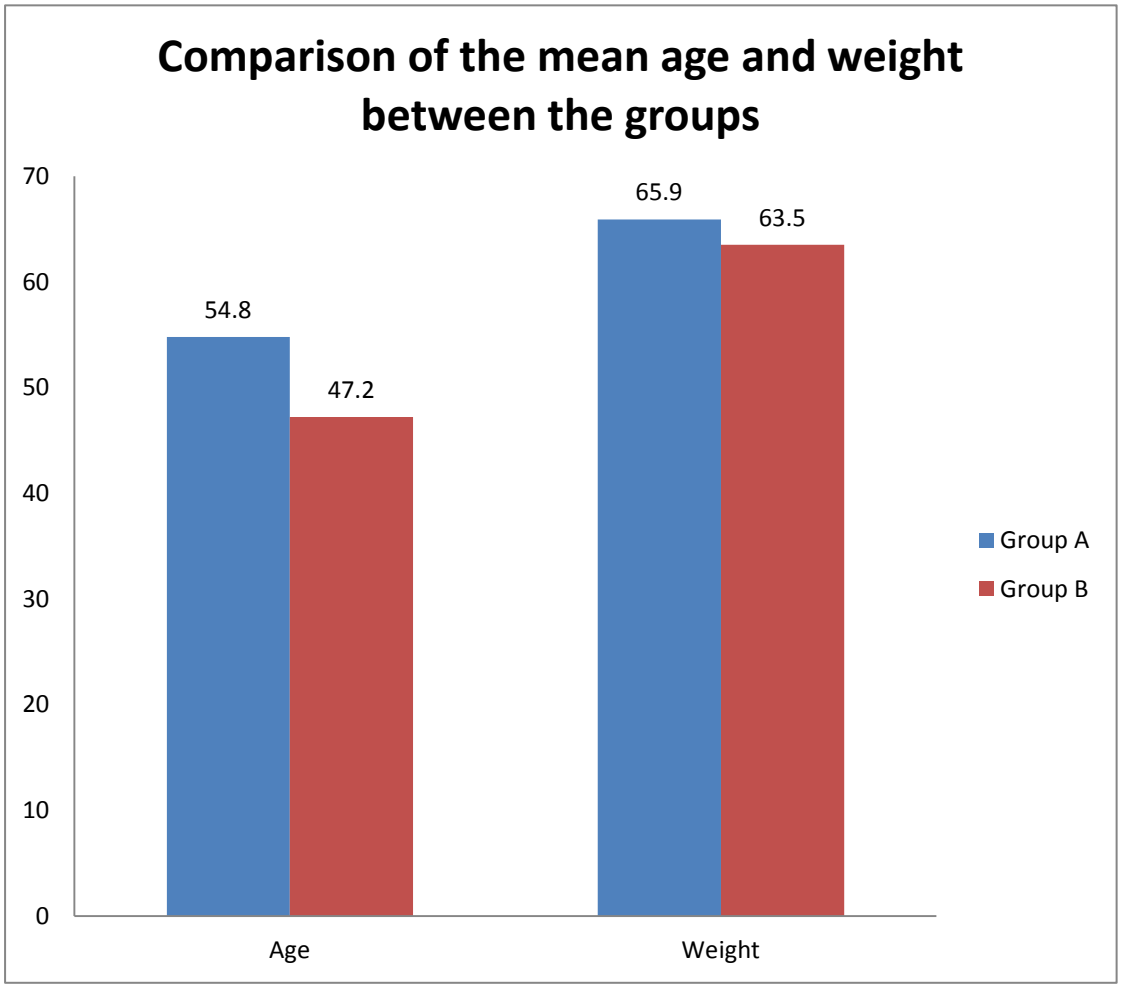

Figure 9: Comparison of the mean age and weight between the groups

Table 4: Comparison of distribution of patients between the groups

		Group A		Group B	
		Count	Column N %	Count	Column N %
Sex	Female	3	21.4%	5	35.7%
	Male	11	78.6%	9	64.3%

On comparison of the distribution of gender between the group, there is no significant difference noted.

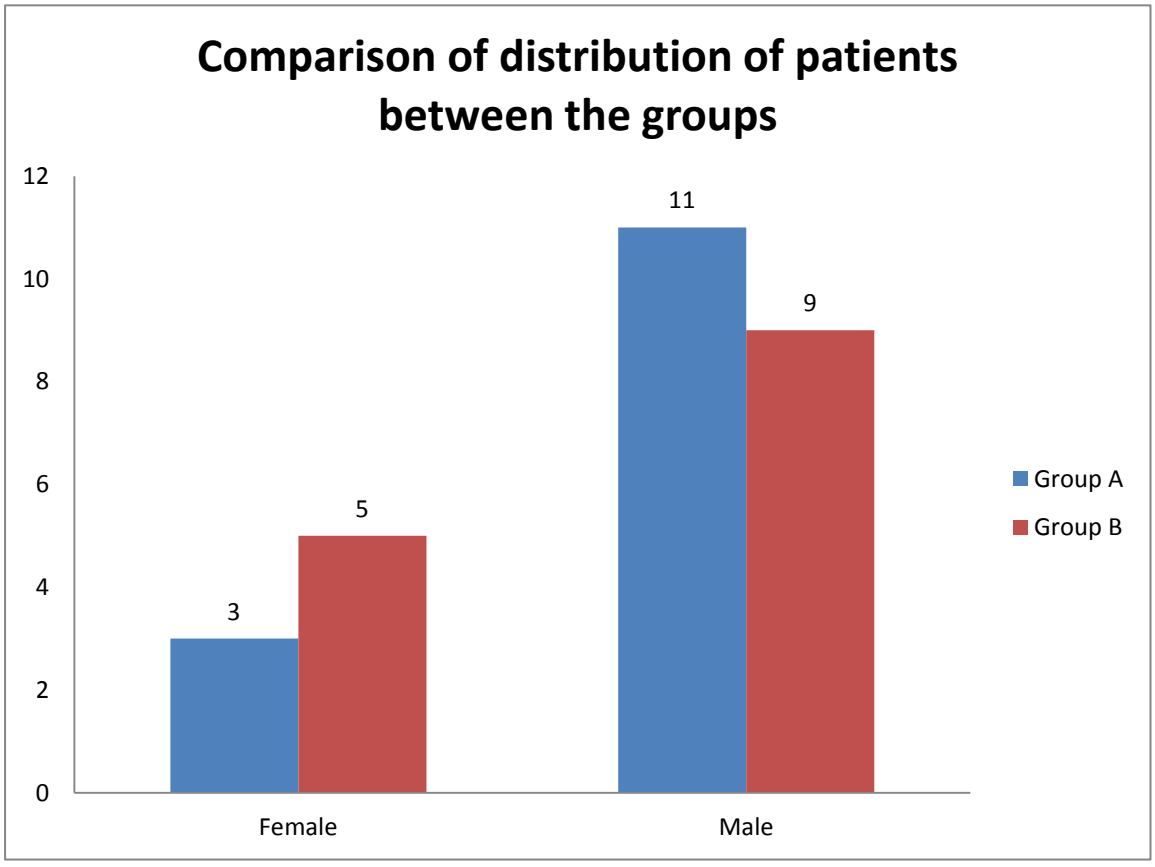

Figure 10: Comparison of distribution of patients between the groups

Table 5: Comparison of mean heart rate between the group at various interval of time

Heart rate	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Baseline	92.4	7.5	89.8	10.1	0.450
At the time of block	92.1	8.2	96.9	12.1	0.233
5mins after block	91.7	8.5	94.6	11.3	0.456
10mins after block	91.4	8.5	92.9	12.5	0.701
15mins after block	89.6	7.5	92.6	12.7	0.454
At time of SAB	90.7	6.7	94.0	9.6	0.304
5mins after SAB	87.7	9.7	94.9	10.8	0.78
10mins after SAB	87.4	8.4	95.6	13.0	0.055
15mins after SAB	87.9	10.2	92.6	10.0	0.227
20mins after SAB	86.8	11.0	90.1	11.5	0.436
30mins after SAB	86.3	11.0	88.5	10.9	0.597

On comparing heart rate between groups no appreciable distinction was noted at various interval of time. ($p>0.05$)

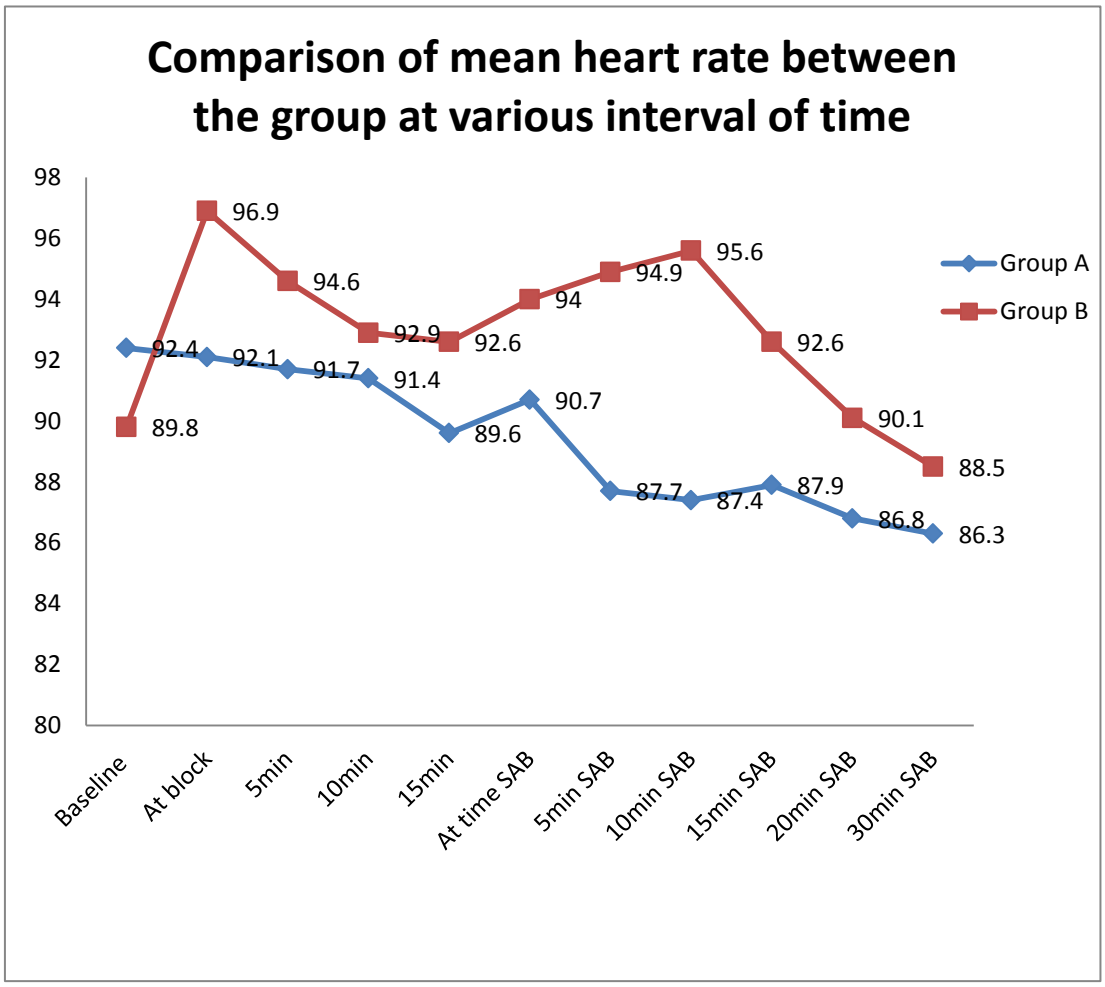

Figure 11: Comparison of mean heart rate between the group at various interval of time

Table 6: Comparison of mean arterial pressure between the groups at various interval of time

Mean arterial pressure	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Baseline	93.4	11.5	91.5	6.7	0.606
At the time of block	94.4	9.5	94.4	8.3	0.993
5mins after block	93.9	10.7	92.4	7.9	0.677
10mins after block	91.5	10.2	91.7	9.7	0.955
15mins after block	90.9	9.7	91.3	9.6	0.907
At time of SAB	93.6	11.9	95.6	14.1	0.699
5mins after SAB	84.0	8.4	90.2	11.6	0.117
10mins after SAB	83.4	7.3	86.6	9.1	0.323
15mins after SAB	82.8	9.3	86.1	8.8	0.347
20mins after SAB	82.4	9.4	88.5	9.3	0.098
30mins after SAB	82.6	7.8	88.9	9.4	0.068

On comparing MAP between groups no appreciable distinction was noted at various interval of time. ($p>0.05$)

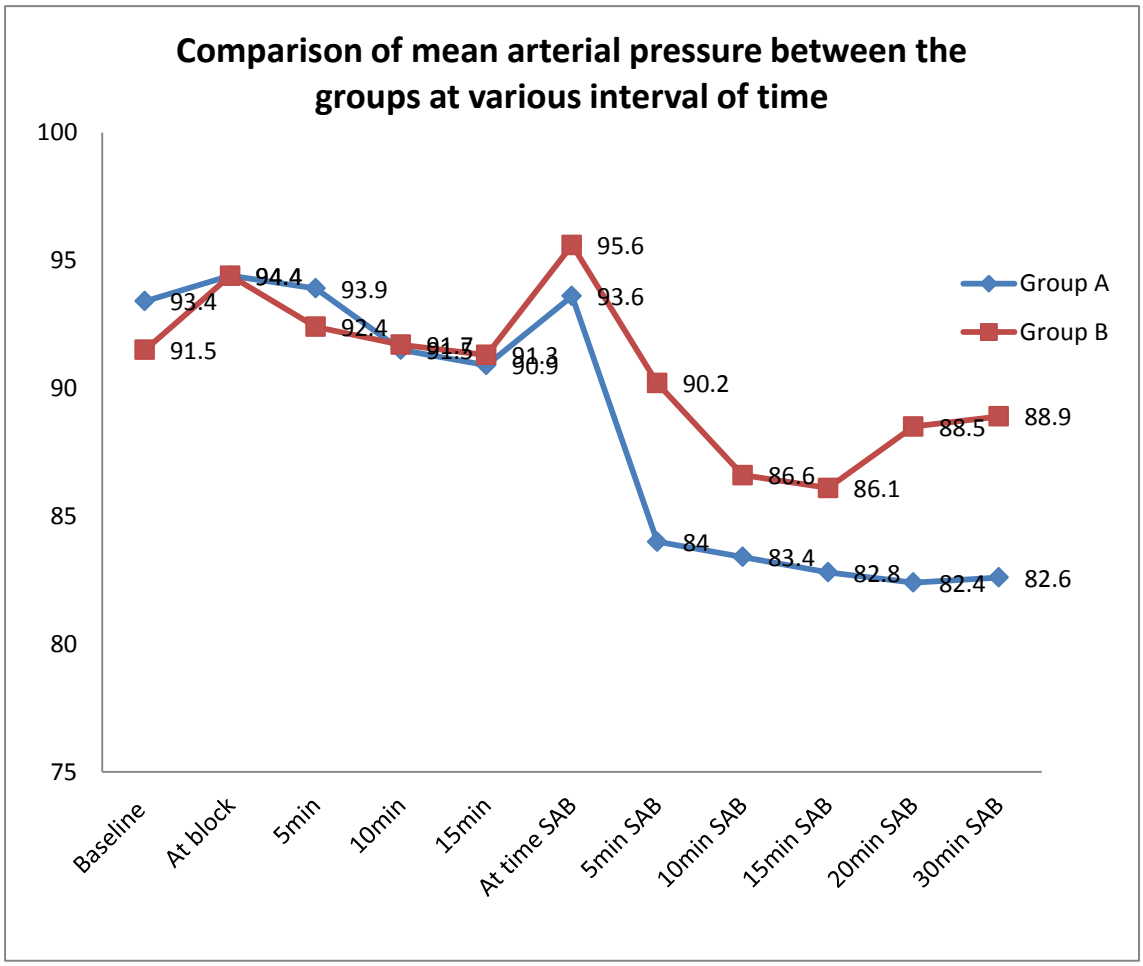

Figure 12: Comparison of mean arterial pressure between the groups at various interval of time

Table 7: Showing the mean VAS score between the group at rest in various interval of time

VAS AT REST	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Baseline	7.7	1.6	7.4	.7	0.453
At time of block	7.5	1.5	7.4	.7	0.753
5mins after block	6.3	1.1	6.2	.9	0.855
10mins after block	5.2	1.1	5.3	.6	0.836
15mins after block	4.4	1.3	4.7	.7	0.490
20mins after block	3.5	1.2	3.7	.7	0.578
Time of Positioning for SAB	3.9	1.2	3.2	1.3	0.172
6hrs after block	4.3	1.0	3.5	.5	**0.014***
12hrs after block	4.7	1.3	4.2	.4	0.173
24hsr after block	5.4	.9	5.1	.5	0.331

There is comparable pain VAS score at rest at various interval between the groups. There is significant lower mean VAS score at 6^{th} hr after block. ($p<0.05$)

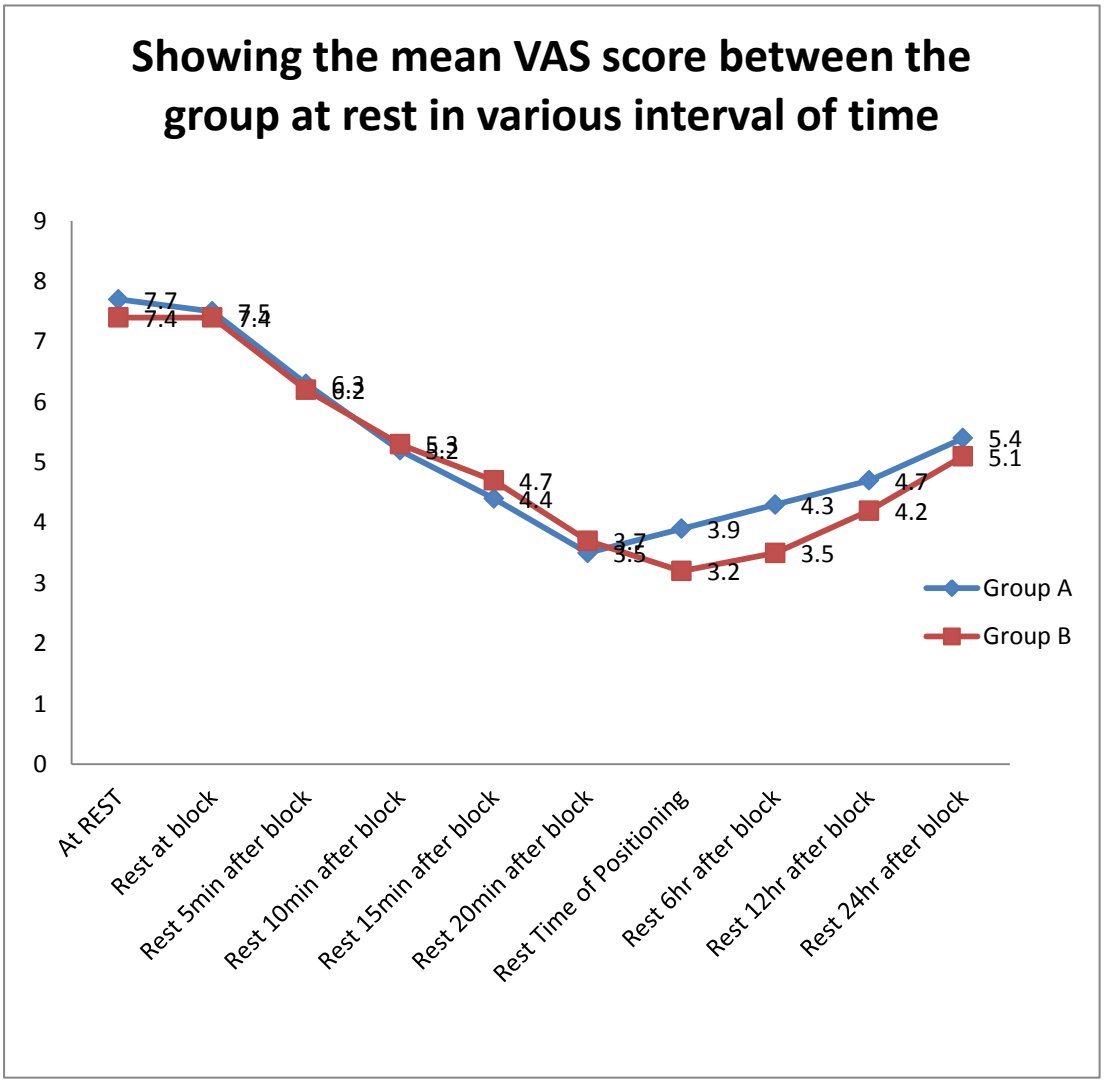

Figure 13: Showing the mean VAS score between the group at rest in various interval of time

Table 8: Showing the comparison of mean VAS score at movement between the group at various interval of time

VAS with Movement	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Baseline	9.1	1.3	9.4	.7	0.491
At time of block	8.9	1.3	9.4	.7	0.286
5mins after block	7.9	1.2	8.5	.8	0.096
10mins after block	6.9	1.0	7.6	.9	0.066
15mins after block	5.9	1.4	6.5	.5	0.160
20mins after block	5.1	1.0	5.5	.9	0.327
Time of Positioning	5.3	1.1	5.0	1.4	0.552
6hrs after block	5.6	.9	5.3	.7	0.348
12hrs after block	6.1	1.0	5.6	.5	0.113
24hrs after block	6.9	.9	6.7	.6	0.473

In the present study on movement the mean VAS score was comparable between the groups. However the mean VAS score was lower after 6hr of block in group B compared to group A ($p>0.05$)

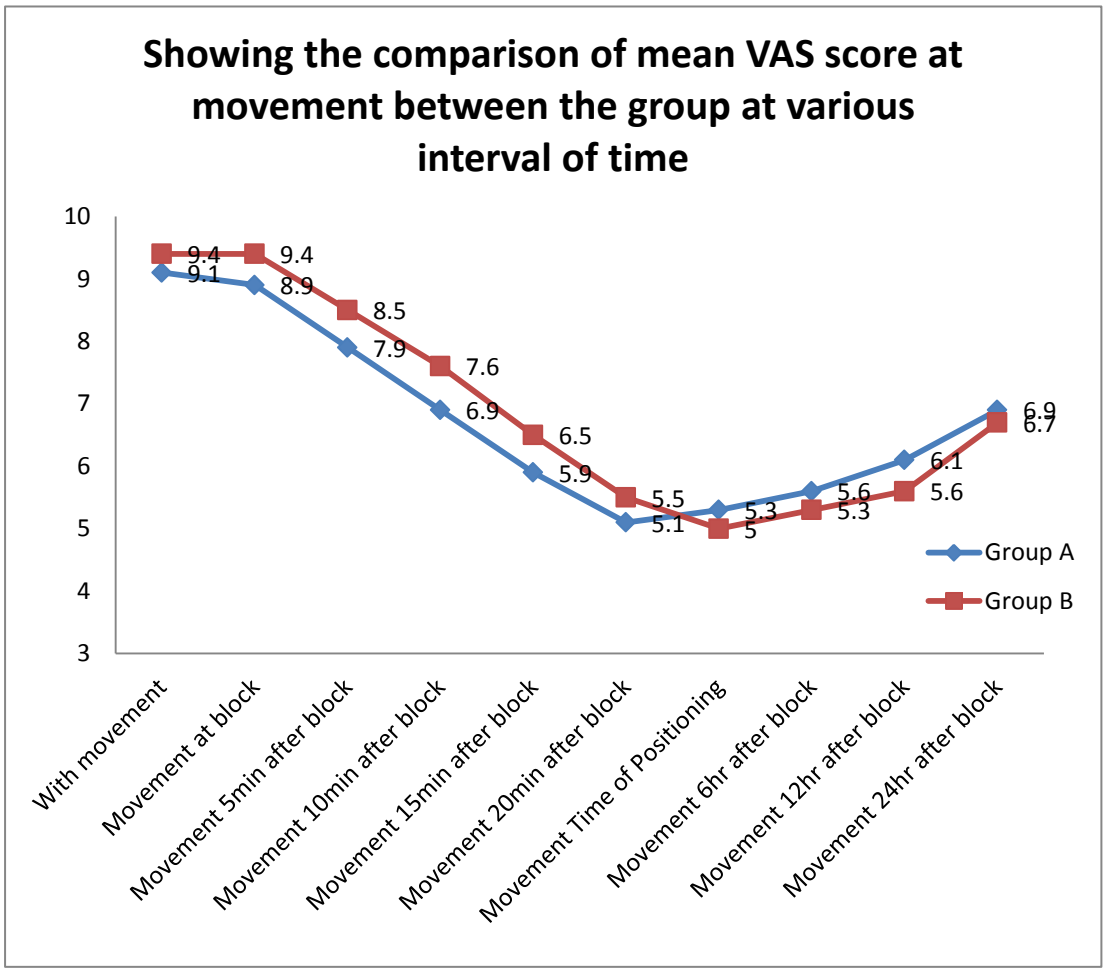

Figure 14: Showing the comparison of mean VAS score at movement between the group at various interval of time

Table 9: Showing the mean duration of first rescue analgesic required and dose of tramadol between the groups

	Group A		Group B		p-value
	Mean	**SD**	**Mean**	**SD**	
Time of first Rescue analgesic in Mins	388.9	19.0	445.0	17.4	**0.001****
Tramadol	2.5	.7	1.9	.6	**0.025***

"On comparison of the time for first rescue analgesic requirement was significantly longer duration in group B compared to group A patients.($p<0.05$) similarly the mean dose of tramadol was significantly lower in group B compared to group A patients.($p<0.05$)"

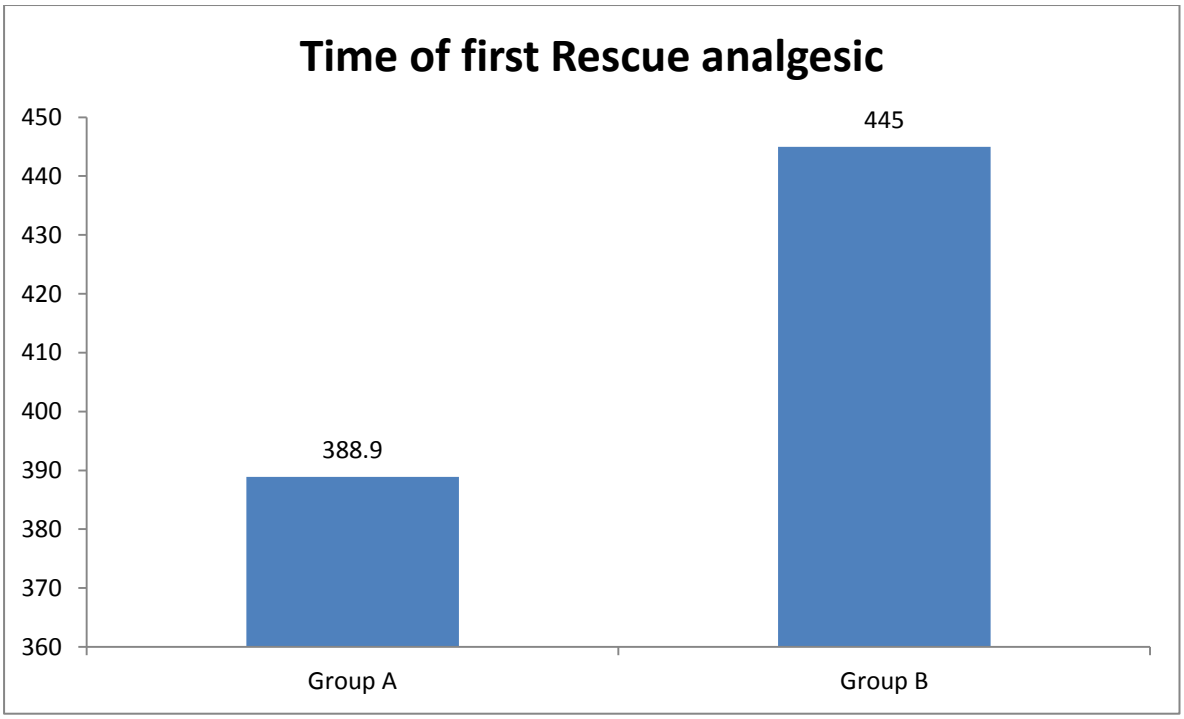

Figure 15: Showing the mean duration of first rescue analgesic required between the groups

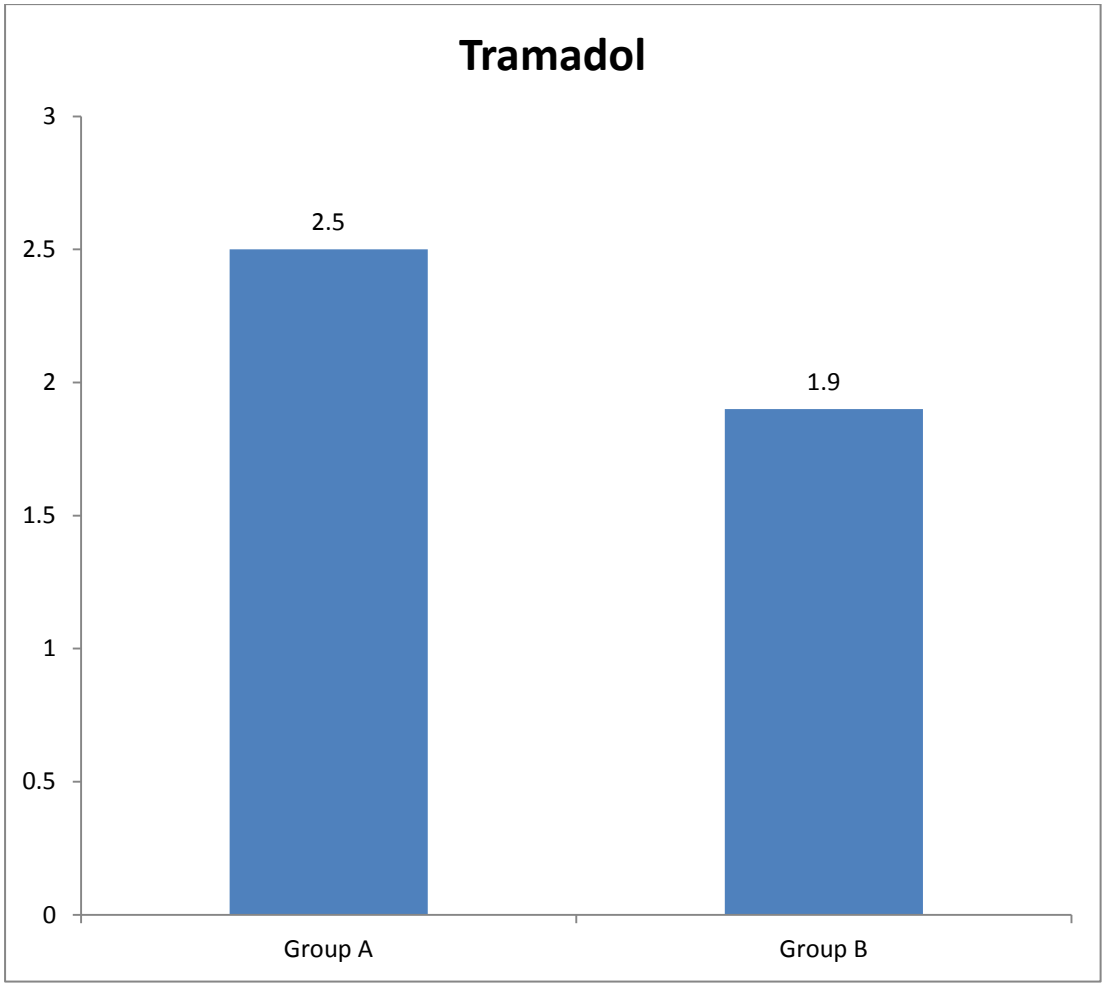

Figure 16: Showing the mean dose of tramadol between the groups

DISCUSSION

DISCUSSION

Excruciating pain is felt by hip fracture patients, which would prevent ideal positioning of the patient for the neuraxial blockade.

In the past Femoral nerve (FN) block, Fascia Iliaca Block (FIB) and 3-in-1 block were used for hip fracture. These blocks not only provided perioperative analgesia but also reduce the opioid requirement in such a patients.[3,4] Branches from the femoral nerve, obturator nerve, and accessory obturator nerve innervate the anterior hip capsule. Current evidence suggests ultrasound guided PENG block very much effective in blocking above mentioned nerves compared to above mentioned blocks.

The PENG block is an unique localised analgesic approach to lessen pain following total hip arthroplasties (THA) while preserving motor function, as initially suggested by L Girón Arango and colleagues. The local anaesthetic agent was deposited using this method in fascial plane separating superior pubic ramus and psoas muscle[7,8].

In patients undergoing hip fracture surgery, PENG block administered prior to SAB gives more excellent analgesia for appropriate positioning during central neuraxial block. In addition, Ropivacaine, a long acting local anaesthetic has reduced CNS and cardiac toxicity and also has less propensity for motor blockade compared to bupivacaine.[9]

Studies have shown that, adding dexamethasone to local anaesthetic would significantly prolong postoperative analgesia.[57] The current study sought to determine the efficacy of PENG. block using local anaesthesic agent ropivacaine alone and comparing with

ropivacaine and dexamethasone with help of Pain score for patient positioning during neuraxial blockade and for the purpose of comparing postoperative analgesia duration.

The mean age among participants was found to be 51±18.6yrs with minimum age of 21yrs and maximum age of 85yrs. Male preponderance was noted with 71.4% male subjects and 28.6% female subjects. On comparison of mean age and weight there is no discernible difference between two groups of patients.

There was no discernible difference in either heart rate or mean atrial pressure among the groups at various interval of time among the study participants. of time among the study participants. ($p>0.05$) . The VAS score at rest were similar between groups at various time intervals. However, at 6^{th} hour the mean VAS score in group B was lower than in group A. ($p>0.05$). Furthermore, time for first rescue analgesic requirement was substantially longer time frame in group B(445.0 mins) than group A patients(388.9 mins)($p<0.05$) and similarly the mean dose of tramadol was comparatively lesser in group B (190mg) than group A patients(250 mg)($p<0.05$)

Study done by Huda AU et al., showed similar results with regards to opioid consumption within the first 24 hours and duration of analgesia .They concluded that PENG block for hip surgery patients is associated with substantial decrease in opioid intake (0.54 mg) in first 24 hours following surgery ($p=0.05$) and increased duration of analgesia in post operative period.[47]

G. Pascarella and colleagues studied impact of PENG block on patients who had total hip replacement surgery. They determined that there had been significantly lesser post operative pain score in patients who received PENG block. Furthermore, patient with

PENG block had a considerable reduction in opioid intake, a better range of hip mobility, and a shorter time to ambulate.[51]

The findings of our study show that adding dexamethasone to ropivacaine greatly prolong the analgesic effect of plain ropivacaine postoperatively(difference of 56 mins). These findings are consistent with prior research using dexamethasone; however, precise comparisons are difficult due to the range of local anaesthetic mixtures and adjuvants utilised, various blocks evaluated, and different ways of measuring block duration.[57]

The present study is one among the very few studies which focused to assess the utility of ropivacaine and ropivacaine with dexamethasone in patients for Ultrasound guided Pericapsular Nerve Group (PENG) block for Hip surgery. In our study, we observed that the duration of postoperative analgesia was significantly longer in time (445 mins) in addition to less requirement of rescue analgesia dose in patients who received dexamethasone as an adjuvant to ropivacaine.

LIMITATIONS OF THE STUDY

1. Smaller sample size
2. Non consideration of analgesics given to patient in wards before getting shifted to operation room.
3. Patient satisfaction in general with anaesthesia care should have been assessed 24 hours postoperatively.

CONCLUSION

CONCLUSION

Ultrasound guided PENG block is an effective modality to attenuate perioperative pain in patients with fracture hip. Dexamethasone as an adjuvant to ropivacaine definitely prolonged the duration of analgesia and decreased the requirement of opioids in the post operative period.

SUMMARY

SUMMARY

The present parallel designed randomized controlled trial study was conducted among the patients aged more than 18 years posted for hip fracture surgery under spinal anaesthesia at R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar during period of January 2021 to May 2022.Written informed consent was obtained. Patients were divided into two groups according to computer generated random table. . Group A: Receiving PENG block with 20 ml of 0.5% Ropivacaine. Group B: Receiving PENG block with 20ml of 0.5% Ropivacaine with 8mg Dexamethasone. Severity of pain according to VAS score was recorded at rest and movement at the time of PENG block and at 5 minutes interval until 20 minutes following block and after positioning the patient for SAB. Patient were given subarachnoid block in sitting position at L3-L4 space with 0.5% of Bupivacaine (H) 3ml with 25micrograms of Fentanyl with 25G Quincke spinal needle with aseptic precautions Heart rate, NIBP, SPO2 was monitored throughout the procedure and adverse effects if any were noted. VAS score at rest and with movements was recorded at 6hrs, 12 hrs, 24hrs after PENG block. Collected data were coded and entered into an excel data base. All the data were analysed using SPSS v21 operating on windows 10 with a $p<0.05$ was considered as statistically significant.

The present study aimed to assess the effectiveness of PENG block using ropivacaine alone and ropivacaine with dexamethasone with help of Pain score for patient positioning during neuraxial blockade and to compare the duration of postoperative analgesia. Based on our study there is comparable pain VAS score at rest at various interval between the groups and there is significant lower mean VAS score at 6^{th} hr after block. ($p<0.05$) and with movement the mean VAS score was comparable between the groups. However, the mean VAS score was lower after 6hr of block in group B compared to group A.($p>0.05$)

On comparison of the time for first rescue analgesic requirement -group B was significantly had longer duration compared to group A patients.($p<0.05$) similarly the mean dose of tramadol was significantly lower in group B compared to group A patients.($p<0.05$)

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ANNEXURES

ANNEXURE

PROFORMA

Sl no.

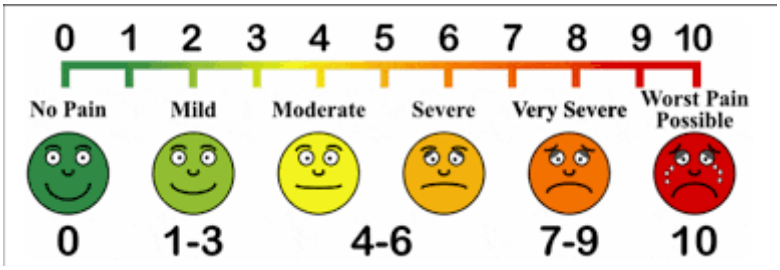
Title of the study: Ultrasound guided PEricapsular Nerve Group (PENG) block for Hip surgery. A Randomized Controlled study comparing Ropivacaine and Ropivacaine with Dexamethasone

UHID No. Age (years):
Gender: Weight (Kg):
Height (Cm): IBW (Kg/m^2):
ASA Grading:
Surgical Details:
Time of Block:
Surgery Start time: End time: Duration (min):

Hemodynamic Variables:

Time Frame	Heart Rate (bpm)	Mean Arterial Pressure (mmHg)
Base line		
At the time of block (T0)		
5 min after block (T5)		
10 min after block (T10)		
15 min after block (T15)		
At the time of SAB (S0)		
5 min after SAB (S5)		
10 min after SAB (S10)		
15 min after SAB (S15)		
20 min after SAB (S20)		
30 min after SAB (S30)		

Pain Score on Visual Analog Scale (VAS)



Time Frame	VAS score at REST	VAS Score with movement
Base line		
At the time of block (T0)		
5 min after block (T5)		
10 min after block (T10)		
15 min after block (T15)		
20 min after block (T20)		
At the time of Positioning (TP)		

Postoperative Period:

Time frame	VAS score at REST	VAS score with movement
6 hrs after block		
12 hrs after block		
24 hrs after block		

Time of First Rescue Analgesic (minutes):

Total Dose of TRMADOL in the first 24 hours:

Complications of Block:

Adverse effects of Study drug:

INFORMATION SHEET

TITLE: ULTRASOUND GUIDED PERICAPSULAR NERVE GROUP (PENG) BLOCK FOR HIP SURGERY. A RANDOMIZED CONTROLLED TRIAL STUDY COMPARING ROPIVACAINE AND ROPIVACAINE WITH DEXAMETHASONE

I, **DR. ASWIN B** Post graduate in the department of Anaesthesiology, Sri Devaraj Urs Medical College, Kolar . We are carrying out above mentioned study at RLJH, Tamaka, Kolar. The study has been reviewed and approved by the institutional ethical review board. We will be checking the effectiveness of PENG block for patient positioning during neuraxial blockade and also will be comparing the duration of postoperative analgesia with ropivacaine alone and ropivacaine with dexamethasone.

Participation in this study doesn't involve any added cost to the patient. There is no compulsion to participate in this study and you will not be affected with regard to patient care, if you wish not to be part of this study.

All the information collected from the patient will be kept confidential and will not be disclosed to any outsider, unless compelled by the law. The information collected will be used only for this study. I request your kind self to give consent for the above mentioned research project.

For any further clarification you are free to contact,

Dr. ASWIN B
(Post Graduate in Anaesthesiology)
Mobile no: 8489860157.
Dr. SURESH KUMAR.N.
(Professor in Anaesthesiology)
Mobile no: 9008222550

INFORMED CONSENT FORM

ULTRASOUND GUIDED PERICAPSULAR NERVE GROUP (PENG) BLOCK FOR HIP SURGERY. A RANDOMIZED CONTROLLED TRAIL STUDY COMPARING ROPIVACAINE AND ROPIVACAINE WITH DEXAMETHASONE

Date:

I, _____ aged _____ ,after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for performing PENG Block. The nature and risks involved have been explained to me to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I hereby give consent to provide my history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc., to the doctor / institute etc. For academic and scientific purpose the operation / procedure etc., may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc., responsible for any untoward consequences during the procedure / study.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

_____ _____

(Signature & Name of Pt. Attendant) (Signature/Thumb impression & Name of patient)

(Relation with patient)

Witness 1:

Witness 2:

_____

(Signature & Name of Research person /doctor)

KEY TO MASTER CHART

BP Blood Pressure

HR Heart Rate

VAS Visual Analog Score

MIN Minutes

PENG PEricapsular Nerve Group

SAB Sub Aracanoid Block

Group A PENG block with 0.5% Ropivacaine

Group B PENG block with 0.5% Ropivacaine and 8mg of Dexamethasone

MASTERCHART

S.No.	Group	ASA grading	Age	Sex	Weight	UHID NO	Diagnosis	Surgical details	Hemodynamic variables																				PAIN SCORE ON VISUAL ANALOG SCORE												POST OPERATIVE PERIOD									
									Time frame	Base line		At the time of		5mins afterblock		10 mins after block		15mins after block		At the time of		5 mins after SAB		10 mins after SAB		15mins after SAB		20mins after SAB		30mins after SAB		Base line		At the time of block		5mins after the block		10 mins after block		15 mins after block		20mins after block		At the time of positioning		6hrs after block		12hrs after block		24 hrs after block		Time of first Rescue analgesic	Total doses of rescue analgesic in first 24 hrs	
										Heart rate	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP	VAS at REST	With movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	Rest	Movement	In Mins		TRAMADOL
1	B	1	25	Male	60	924210	Left IT fracture	CRIF + Short PFN Fixation		80	90	82	92	80	92	74	94	74	93	86	98	84	92	85	92	85	90	70	88	68	84	8	10	8	10	8	10	4	6	4	6	3	5	3	5	4	6	5	6	6	8	450		2
2	B	2	65	Female	50	924181	Right neck of femur fracture	CRIF + Long PFN Fixation		90	90	106	94	102	90	100	86	96	88	98	120	110	88	116	83	102	93	98	102	87	100	8	10	8	10	6	9	6	9	5	6	3	5	2	3	3	5	4	5	6	7	430		2
3	A	2	72	Male	62	926017	Closed displaced right IT fracture	CRIF + Short PFN Fixation		92	90	90	94	92	90	92	88	90	86	92	98	96	90	94	92	98	96	98	98	98	96	9	10	7	9	6	8	4	5	2	3	2	4	3	4	5	6	6	7	6	8	380		3
4	A	2	60	Male	72	928412	Closed displaced transcervical neck of left femur fracture	Hemiarthroplasty of left hip		91	92	90	95	94	92	94	90	90	88	90	88	96	92	94	96	96	98	96	98	96	94	9	10	8	9	7	8	5	6	3	4	3	4	3	4	5	6	5	6	6	8	390		3
5	A	2	50	Male	57	945518	Right neck of femur fracture	CRIF + CC screw Fixation		110	75	116	78	112	76	110	72	108	70	106	70	106	70	104	72	110	68	108	66	110	68	8	10	8	10	6	8	6	8	5	8	4	6	5	8	5	6	5	7	6	7	370		2
6	B	1	28	Male	50	947068	Left subtrochantric fracture	CRIF + Short PFN Fixation		82	92	84	94	82	94	78	94	78	95	88	98	88	98	87	94	86	92	78	88	80	78	8	9	8	9	8	9	5	7	5	7	4	5	4	5	4	6	4	6	5	7	440		2
7	A	1	55	Female	60	948157	Left IT fracture	CRIF + Short PFN Fixation		90	94	92	96	94	94	98	88	94	90	90	92	88	88	90	86	92	84	94	85	90	86	3	5	3	5	3	5	2	5	2	5	2	5	2	4	3	4	3	4	4	5	420		1
8	B	2	85	Male	55	947965	Closed displaced right IT fracture	Hemiarthroplasty of right hip		105	100	110	108	106	105	110	108	112	108	110	106	104	104	100	102	96	100	96	98	96	98	6	10	6	10	5	8	5	8	4	7	4	7	4	8	4	6	4	6	5	7	450		2
9	B	1	21	Male	65	971065	Closed displased subtrochantric fracture of left femur	CRIF + Short PFN Fixation		90	98	104	94	100	90	100	88	96	88	98	86	100	86	110	88	104	84	98	96	98	98	8	10	8	10	6	9	6	9	5	6	3	5	1	3	3	5	4	5	5	7	470		2
10	B	2	53	Female	71	985572	Closed diplaced neck of right fumer fracture	Total hip replacement		88	90	94	96	96	94	88	92	90	90	90	92	94	88	88	86	88	90	90	88	90	90	7	9	7	9	6	9	5	7	5	7	4	6	3	5	3	5	4	6	4	6	450		2
11	A	2	50	Female	60	986854	Right IT fracture	CRIF + Short PFN Fixation		96	100	90	102	90	104	92	108	88	100	90	100	90	96	88	90	86	88	80	86	78	84	8	9	8	9	6	7	6	7	6	7	5	6	5	6	4	5	4	6	4	6	400		3
12	A	3	47	Male	78	987712	Left neck of femur fracture	CRIF + CC Screw Fixation		92	98	94	100	96	98	94	96	94	98	96	98	90	88	88	86	86	82	86	80	86	80	7	9	7	9	7	8	5	7	4	6	3	5	4	5	3	5	3	5	4	6	360		3
13	B	2	36	Female	55	971099	Closed displaced neck of right femur fracture	Hemiarthroplasty of right hip		88	90	100	92	92	96	94	98	96	96	96	94	90	88	91	86	90	84	94	86	96	90	8	10	8	10	7	9	6	8	6	7	5	6	3	5	3	6	4	6	5	7	440		3
14	B	2	40	Female	68	989605	Closed displaced communicated left IT fracture	CRIF +Short PFNfixation		90	90	104	96	102	92	98	94	98	92	94	92	94	90	92	89	90	88	86	90	88	92	7	9	7	9	6	8	5	7	4	6	4	5	3	5	4	6	4	6	5	6	480		2
15	B	3	85	Male	85	55441	Closed displaced IT fracture of Right femur	CRIF + Short PFN Fixation		84	102	86	104	90	100	88	98	88	96	88	96	90	90	88	88	86	88	84	92	80	90	7	9	7	9	6	8	6	7	6	7	5	6	5	6	3	4	4	5	5	6	450		3
16	B	1	36	Male	36	55672	Closed displaced intertrochanteric fracture of left femur	CRIF +Short PFNfixation		80	84	82	84	80	82	78	80	78	82	80	82	80	78	78	76	80	74	78	76	76	80	7	8	7	8	6	7	5	7	4	6	3	4	4	5	3	4	4	5	5	7	420		1
17	A	3	60	Male	54	58879	Left femur neckfracture	Modular BipolarHemiarthroplasty		84	94	86	92	84	90	86	88	84	86	84	86	82	82	86	80	84	79	85	77	84	78	9	10	9	10	7	9	6	8	5	7	4	6	5	6	4	4	5	6	5	7	390		2
18	A	1	59	Male	76	66851	Left IT fracture	Open reduction internal fixation + Proximal femoral nailing		94	80	92	82	90	88	93	90	90	88	88	84	86	82	82	80	82	78	80	76	82	78	7	8	7	8	6	8	5	6	4	5	3	4	3	5	3	5	3	5	5	6	410		3
19	A	3	84	Male	65	68047	Right neck of femur fracture	Bipolar Hemiarthroplasty		96	110	92	105	90	104	90	102	89	104	95	110	80	75	78	80	80	78	74	80	72	81	8	9	8	9	6	7	6	7	6	7	5	6	5	6	6	7	7	8	7	8	350		3
20	B	2	70	Male	72	69021	Closed displaced communicated right IT fracture	CRIF + PFN fixation		76	88	78	89	76	88	77	84	76	82	78	80	76	74	78	72	76	74	78	75	78	76	7	8	7	8	6	8	5	7	4	6	3	5	3	5	4	5	5	6	5	6	420		2
21	A	2	55	Female	61	79810	Closed displaced communicated intertrochanteric fracture of right femur	CRIF + Proximal nailing of right femur fracture		80	84	81	84	78	80	78	78	79	80	80	80	76	70	74	72	72	73	74	76	74	76	7	9	7	9	7	8	6	8	5	6	4	6	4	5	4	6	4	6	5	7	400		2
22	A	1	28	Male	65	79884	Right neck of femur fracture	Hemiarthroplasty of right hip		82	92	84	92	80	94	74	93	76	96	80	94	78	90	85	82	80	78	74	76	74	78	9	10	9	10	8	10	5	7	5	6	4	6	3	5	3	6	4	6	6	8	385		2
23	B	1	43	Female	76	79972	Closed diplaced intertrochantric fracture of right fumer fracture	CRIF + PFN fixation		90	90	104	93	102	89	100	86	96	88	98	120	110	115	114	88	105	83	100	92	96	100	8	10	8	10	6	9	6	9	5	6	3	5	1	3	3	5	4	5	6	7	430		1
24	A	1	34	Male	80	81534	Left intertrochantric fracture	CRIF + Short PFN Fixation		92	88	90	94	92	90	92	88	90	86	92	98	96	90	94	90	98	98	98	96	96	94	9	10	9	10	7	9	6	8	4	5	1	3	2	4	5	6	6	7	6	7	400		3
25	B	2	53	Male	73	83924	Right intertrochantric fracture	Open reduction internal fixation + short PFN fixation		110	77	112	78	110	76	106	74	108	72	106	70	104	72	110	70	108	69	110	70	106	72	8	10	8	10	6	8	5	7	5	7	4	6	5	6	4	5	5	6	5	6	460		2
26	A	2	48	Male	68	84576	Closed displaced right IT fracture	CRIF + PFN fixation		96	120	92	115	90	120	90	110	89	106	95	117	70	75	74	76	76	75	76	78	78	80	8	9	8	9	6	7	6	7	6	7	5	6	5	6	5	6	5	6	6	7	390		3
27	A	2	65	Male	65	89746	Right neck of femur fracture	Hemiarthroplasty of right hip		98	90	100	92	102	94	96	90	94	94	92	96	94	88	92	86	90	84	92	82	90	84	7	9	7	9	6	8	5	7	5	7	4	5	5	6	5	6	6	7	6	7	400		2
28	B	1	21	Male	73	89862	Closed displaced subtrochantric fracture of left femur	CRIF + Long PFN Fixation		104	100	110	108	106	105	110	108	111	108	106	104	104	100	102	98	100	96	102	98	100	96	6	9	6	9	5	8	5	8	4	7	4	7	4	6	4	6	4	6	5	7	440		1