"COMPARISON OF ANALGESIC EFFICACY BETWEEN PERICAPSULAR NERVE GROUP BLOCK AND FASCIA ILIACA COMPARTMENT BLOCK FOR POSITIONING DURING SUBARACHNOID BLOCK IN PROXIMAL FEMUR FRACTURES – HOSPITAL BASED A RANDOMIZED CONTROLLED TRIAL "

BY

REG NO: BA0121001

Dissertation

Submitted to

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IN

ANAESTHESIOLOGY

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Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"COMPARISON OF ANALGESIC EFFICACY BETWEEN PERICAPSULAR NERVE GROUP BLOCK (PENG) AND FASCIA ILIACA COMPARTMENT BLOCK (FICB) FOR POSITIONING DURING SUBARACNOID BLOCK IN PROXIMAL FEMUR FRACTURES – HOSPITAL BASED, A RANDOMIZED CONTROLLED TRIAL"** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

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ABBREVATIONS

ASA	American Society of Anaesthesiologists
PENG	Pericapsular Nerve Group Block
FICB	Fascia Iliaca Compartment Block
FNB	Femoral Nerve Block
SM	Sartorius Muscle
IPE	Ilio-pubic Eminence
IM	Iliacus Muscle
ASIS	Anterior Superior Iliac Spine
LFCN	Lateral Femoral Cutaneous Nerve
RCT	Randomized Controlled Trial
USG	Ultrasound Guided
VAS	Visual Analogue Scale
NRS	Numerical Rating Scale
HR	Heart Rate (bpm)
SBP	Systolic Blood Pressure (mm Hg)
DBP	Diastolic Blood Pressure (mm Hg)
SpO2	Saturation of peripheral oxygen (%)

MAP	Mean Arterial Pressure
NIBP	Non-invasive Blood Pressure
ECG	Electrocardiography
LA	Local Anaesthesia
SA	Spinal Anaesthesia
MHz	MegaHertz

ABSTRACT

Introduction :

Hip and neck of femur fractures are most commonly occurring fractures in old age people with severe pain. Our study was done comparing analgesic efficacy between Ultrasound guided Fascia Iliaca Compartment Block (FICB) and Pericapsular Nerve Group Block (PENG) prior to spinal anaesthesia using 15ml of 0.75% of Ropivacaine drug.

Methodology :

RCT conducted in the KLE's hospital , JNMC, Belgaum. The primary aim was to assess pain before and after giving PENG or FICB in proximal femur fracture cases using 0.75% Ropivacaine. 60 patients were recruited in the study and randomised based on computer generated randomization, and were allotted into two groups equally in each group.

After acquiring informed consent from the patients, attaching all standard monitors (Sp02, NIBP, ECG LEADS). Using Visual Analogue Scale (VAS) pain assessment done prior to block. The block was given in the preoperative room 30 minutes before shifting to Operating room(OR).

Under the USG, a block was given using 0.75% Ropivacaine 15ml in each group. The pain was assessed again using VAS scale post procedure. Haemodynamic parameters were also assessed.

Results :

The VAS scale for pain was assessed pre-block. Post-block there was significant reduction in pain (Group P 6.9 to 1.5 and Group F 6.9 to 1.47). But it was comparable at any given time. No significant difference seen in heart rate, blood pressure.

Keywords :

PENG Block, FICB, Proximal femur fractures, Ropivacaine.

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INTRODUCTION

Proximal femur trauma due to fall are the serious concern in geriatric agegroup. With the associated co-morbidities in the age and fracture induced pain make them more vulnerable in the perioperative period. [1]

Excruciating pain around hip joint following trauma will have psychological impact on diseased patient. Acute pain can exacerbate the pre-existing co-morbidities.

Adequate pain management following proximal femur fractures in elderly is crucial for positioning during anaesthesia, early ambulation and patient satisfaction. [2]

Compromised position due to fracture site pain during spinal anaesthesia makes it difficult for the anaesthesiologist to intervene. Opioids are frequently used to treat hip fractures and provide analgesia , which can cause delirium, nausea and constipation. [3]

Regional blocks around hip joint ease proper positioning for spinal anaesthesia. PENG, FICB, femoral nerve block (FNB) and lateral cutaneous nerve block (LCNB) are alternative for efficacious analgesia.

PENG is a recent procedure introduced, blocking both Obturator nerve (ON) ,Accessory obturator nerve and Femoral nerve (FN) which supplies anterior hipcapsule. [4] PENG block reduced opioid usage by providing adequate sensory blockade to the hip.

FICB involves the FN, ON and LFCN. By performing FICB technique, it is possible to block these nerve branches and provide important local anaesthesia for surgeries involving the hip and knee joints. [5]

Ropivacaine is a local anaesthetic drug, exhibiting a similar mechanism ofaction to other local anaesthesia blocking sodium ion influx in nerve fibers. The doseis 3-4mg/kg body weight. In comparison to Bupivacaine, Ropivacaine is minimal lipophilic in nature leading to less motor blockade, central nervous system toxicity and cardiotoxicity.[6]

We evaluated the analgesic effectiveness of FICB and PENG block for positioning during subaranchnoid block in patients with proximal femur fractures in this study. Hemodynamic parameters of the patient were also assessed after giving block in both the groups.

OBJECTIVES

Primary objective:

Assessment of pain after PENG block and FICB at the time of positioning for subarachnoid block in proximal femur fracture patients.

Secondary objective:

Hemodynamic parameter assessment after PENG block and FICB, intraoperatively for 30 minutes.

REVIEW OF LITERATURE

Hip and neck of femur fractures in older age group make the patient difficult to position for spinal anaesthesia because of severe pain [5] Excruciating pain while putting patient for subarachnoid block can be minimised by blocking nerves around the hip joint [2]

In a study conducted by Giron Arango et al. a case series of 5 individuals with hip fractures, pain score was reduced after giving PENG block. All the 5 individuals reported VAS scale of 2. [7] They found PENG is an alternative to femoral and fascia iliaca block.

A study done by Senthil et al [8] following surgery analgesia lasted significantly longer in the subset of PENG block than FICB. Usage of opioid in postoperative period was more in FICB group. Study was conducted in 40 individuals and found comparable differences in the duration of post-operative analgesia were not statistically significant and VAS scale between these groups. The VAS scale and the motor power of quadriceps femoris showed the effectiveness of reduction in motor sparing and sensory blockade was notably seen more in PENG block group.

A comparative study done by, Ashok Jadon et al [9] analgesic efficacy of PENG and Supra-inguinal FICB for positioning for SA in 66 patients. With a mixtureof 0.25% Bupivacaine and Dexamethasone 8mg both the groups. Reported pain score in Supra-inguinal FICB and PENG was 4 and 3 respectively after 30 minutes of block. Score after passive leg raise was in PENG block was 4 and in FICB 5. The study concluded PENG block gave a adequate analgesia and helped in placing patient for subarachnoid block.

A total of 60 patients, a study demonstrated by Chaudhary et al [10] compared PENG versus Femoral nerve block (FNB) in proximal femur fractures concluded, analgesic efficacy was better in PENG block group than FNB. But, EOSP score was comparable both the groups. VAS score was below 4 points after 30 minutes of block.

Alrefaey et al [11] ease for positioning between PENG block and control group.It was observed that 24 individuals could easily sit without pain in PENG block group. They demonstrated that PENG block was effective in positioning patient for spinal anaesthesia.

In a case series reported by Bullock et al [12] five patients received USG guided Supra-inguinal FICB with 30ml of 0.2% Inj. Ropivacaine with 1:400,000 Epinephrine. The FICB blocked LFCN and anterior cutaneous FN without motor blockade of FN. The five patients had reduction in pain score and providing a good postoperative analgesia.

A comparison study done by Mosaffa et al [3] PENG block and FICB using 0.5% Ropivacaine drug in hip fracture, reported the VAS scale pre-block there was no difference in both the groups. The difference was notable in PENG block group after 15 minutes of block and 12 hours post-operative period. The duration needed forrescue analgesia was more in PENG block group. The opioid consumption 24 hourswas significantly less in PENG block group.

Acharaya et al [13] reported a case series on PENG block for placing patients for spinal anaesthesia undergoing hip surgeries in 10 individuals. A mixture of 20ml of 0.125% Inj. Bupivacaine with Inj. Dexamethasone 4mg. The NRS score initially

was nine. After the block, the NRS was reduced while positioning. The NRS score was two for three patients, one for the rest of the patients.

A study done by, Hebbard et a [14] Supra-inguinal approach for FICB in cadavers. The USG guided Supra-inguinal approach resulted better action on bothFemoral nerve and LFCN in the iliaca fossa. They concluded, that more of dorsal and proximal spread of LA in the iliaca fossa with a good success rate.

Zhang et al [15] assessed USG guided FICB for post-operative pain management in THR, a total of eight trials done. The adequate amount of 0.33% Ropivacaine was 34.06ml. Postoperatively patient required opioids as rescue analgesia.

In a study conducted by Yong Seon Choi 1 et al [2] concluded the PENG block and FICB was comparable in terms of analgesic efficacy. No significant changes was seen in the quadriceps strength in either of the group.

A study conducted by Matthias Desmet et al (16) reported 88 individuals posted for THA the consumption of opioid 24 hours post-surgery was reduced in FICB block than Control group. The drug used for the block was Ropivacaine 2-3mg/kg body weight.

A comparative study done by Aswin et al [17] PENG given through USG guided reduced perioperative pain during placement in hip fracture for subarachnoid block. The Dexamethasone, used as an adjuvant to ropivacaine, prolonged the post- operative pain and decreased the dosage for opioids in recovery.

BASIC SCIENCES

THE HIP JOINT [18]

Hip joint is surrounded by proximal parts of the thigh musculature and gluteal region.

- Like the shoulder joint, the hip joint is:
    - Ball and socket
    - Synovial joint
- Lower limb must be mobile & weight bearing (must also be stable)
- Hip joint compromises some mobility for stability
- Articular surfaces:
    - Acetabulum (of innominate)

HEAD OF FEMUR

- Head of the femur is spherical and covered with articular cartilage
- Circumference of femoral neck < femoral head
- Femoral neck is susceptible to fracture
- Centre of femoral head is a small pit – dotted with several holes in dry specimen, through which nutrient arteries enter to supply the bone.

Figure 1- Head of the Femur

ACETABULUM

- Formed from ileum, pubis & ischium.
- Ossification of the triradiate cartilage separating these bones is complete by the end of puberty.
- Labrum acetabular is a fibrocartilaginous rim which surrounds the acetabulum, deepening it.
- Near the obturator foramen, the acetabulum is deficient – forming the acetabular notch.
- In the region of the acetabular notch, the circle of the labrum is completed by the transverse ligament.

Branch of the obturator artery – the artery of the ligament of the head of the femur - supplies nutrition to the femoral head by passing through the acetabular notch.

- This artery travels beneath the transverse ligament to the pit of the femoral head (fovea).
- It is surrounded by condensation of fibrous tissue – the ligament of the head of the femur.
- This ligament has no role in strengthening the hip joint.

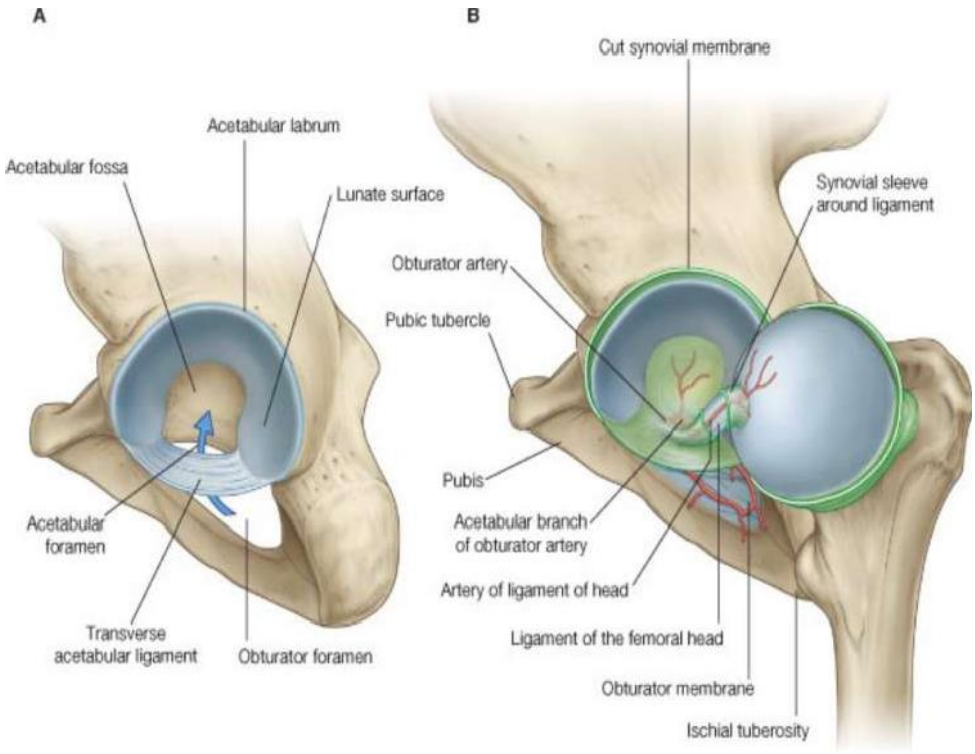

Figure 2 - Acetabulum

FIBROUS CAPSULE OF HIP JOINT

Very strong – responsible for much of hip joint strength.

- Fibers pass from:
  - Circumference of acetabulum
  - femoral neck
- On the front it passes to intertrochanteric line
- On the back it passes half-way to the intertrochanteric crest

Some fibers pass in circular fashion around the capsule – band called the zona orbicularis.

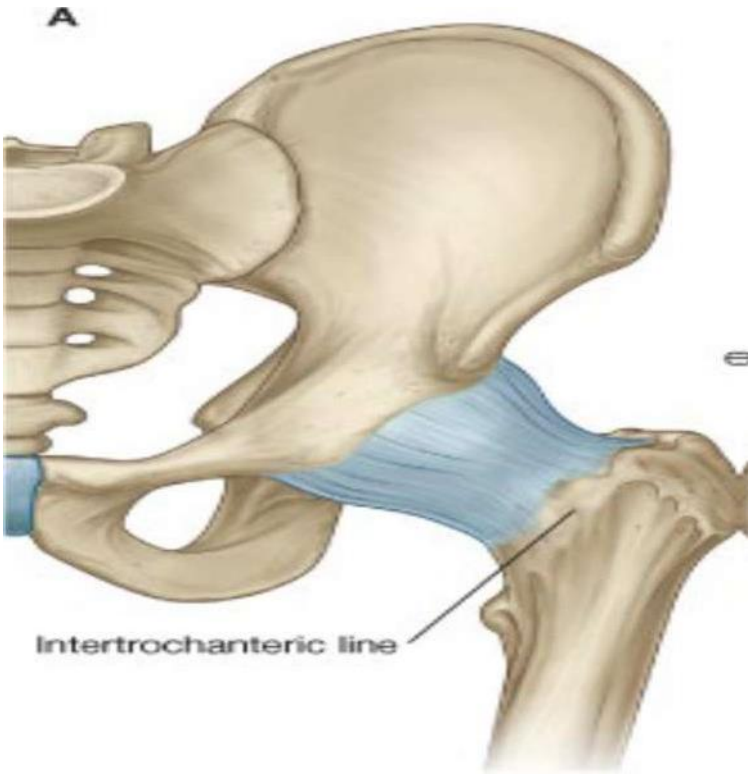

Figure 3- Fibrous capsule of hip joint – Intertrochanteric line

- Fibrous capsule is strengthened at several points to form ligaments:
- Front of capsule: iliofemoral ligament
- Proximal insertion: anterior inferior iliac spine + labrum
- Distal insertion: intertrochanteric line on front of femur
- Centre of ligament is thin – gives an inverted 'Y' thickened region
- One of strongest ligaments in body.
- Lower capsule: pubofemoral ligament
- Proximal insertion: pubic bone
- Distal insertion: lowermost part of intertrochanteric line

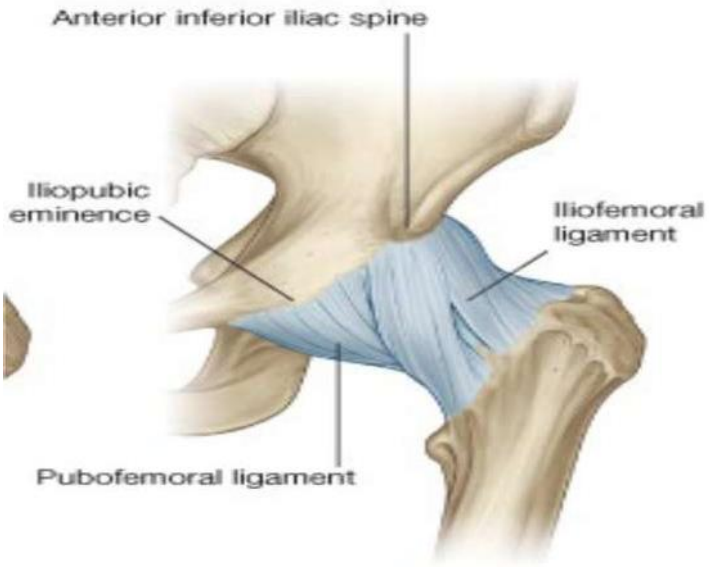

Figure 4 – Fibrous capsule of hip joint – Iliofemoral ligament and Pubofemoral ligament

- Back of capsule: ischiofemoral ligament
- Not as strong
- Proximal insertion: ischium below the acetabulum
- Distal insertion: neck of femur

- Retinacular fibres run from where the capsule inserts into neck of femur to the head.
- Retinacular fibres provide support to blood vessels (like the ligament of the head of femur)

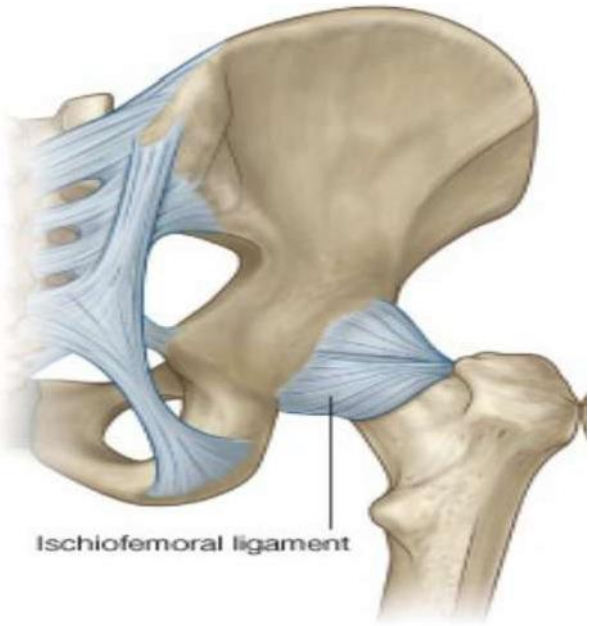

Figure 5 – Fibrous capsule of hip joint – Ischiofemoral ligament

BLOOD SUPPLY TO THE FEMORAL HEAD & NECK:

- Most blood supply to femoral head and neck comes from:
- Medial & lateral circumflex arteries (from profunda femoris)
- Also a contribution from:
    - Superior gluteal artery
    - Inferior gluteal artery
- 1st perforator of profunda femoris Form 2 anastamosis:
    - Trochanteric anastomosis
    - Cruciate anastomosis

- Retinacular fibres protect these vessels as they pass along the femoral neck.
- They enter the bone at various points along the neck.
- Also some blood supply from:
    - Artery of the ligament of the head of the femur
    - This is a branch of the obturator artery which passes through acetabular notch/foramen, deep to the transverse ligament, protected by the ligament of the head of the femur.
- Artery of the ligament of the head of the femur passes to the femoral head where it supplies the bone – producing the pit (fovea) & foramen in the head of the femur.

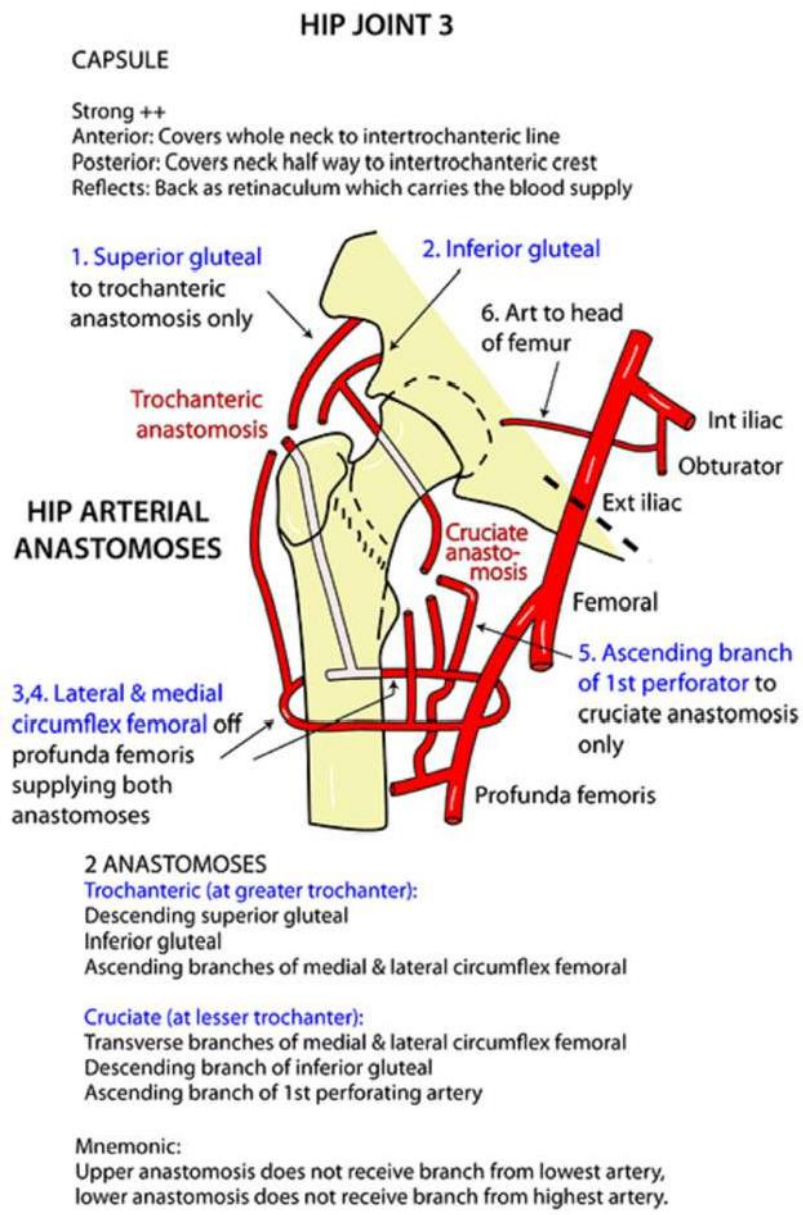

Figure 6 – Blood supply to the Femoral head and neck

NERVES AROUND HIP

LUMBAR PLEXUS: L1,2,3,4,5

- Iliohypogastric (L1)
- Ilioinguingal (L1)

- Lateral femoral cutaneous nerve
- Genitofemoral (L1,2)
- Anterior L2,3,4 = obturator
- Posterior L2,3,4 = femoral
- Lumbosacral trunk (L4,5)

OBTURATOR NERVE: L2,3,4 ant div

- Anterior + posterior divisions around adductor brevis
- Supply adductors of hip (except pectineus)
- Skin over medial thigh

FEMORAL NERVE: L2,3,4 post div

- Splits around lateral circumflex femoral artery
- Iliopsoas
- Quadriceps femoris
- Pectineus (adductor)
- Sartorius
- Medial + intermediate femoral cutaneous nerves - Goes on to form saphenous nerve

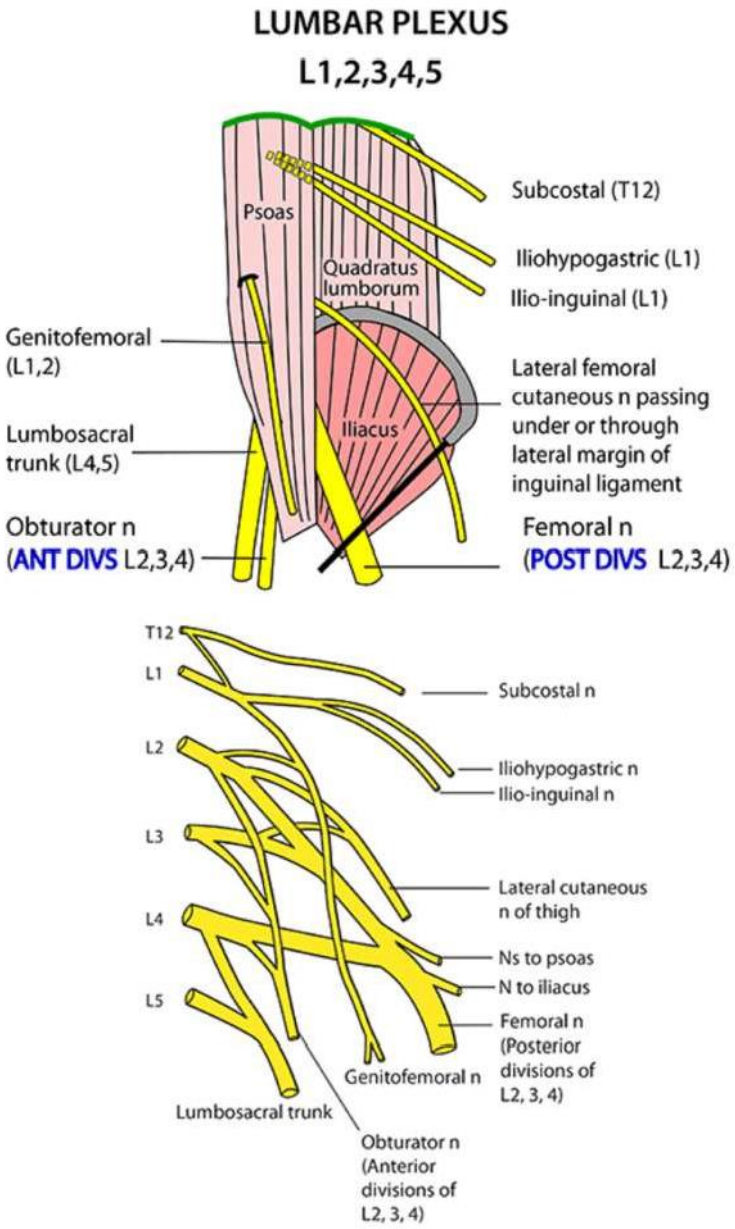

Figure 7 – Nerve supply around Hip

ULTRASONOGRAPHY [19] [20] [21]

Ultrasound waves are sound waves with a frequency greater than 20,000Hz.These frequencies are above the audible upper limit of human hearing. Medical ultrasound is the application of this ultrasound waves to visualize the internal organs of our human body. The frequencies used for this purpose, ranges from 3 to 20 MHz. In recent years, ultrasound is widely used in anaesthesia for obtaining vascular access and performing peripheral nerve blocks. Ultrasound guided techniques helps in increasing success rate and reduce its complications.

Ultrasound Pulse Generation

The ultrasound transducer contains multiple piezoelectric crystals which are interconnected electronically. When mechanical energy is applied to these crystals and some ceramics, they generate electrical energy. This phenomenon known as the "Piezoelectric Effect" was first described by the Curie brothers in 1880. They also described the "Reverse Piezoelectric effect", wherein application of electricity to these crystals produced vibrations which generate ultrasound waves.

Ultrasound Wavelength and Frequency

The wavelength and frequency are inversely related. High frequency ultrasound waves (10 to 20 MHz) give images with a high axial resolution but are more attenuated as we go deeper. Therefore, these transducers are optimal to image the superficial structures. Low frequency ultrasound waves (2 to 8 MHz) penetrate deeper but provide low axial resolution and are used to image deeper structures.

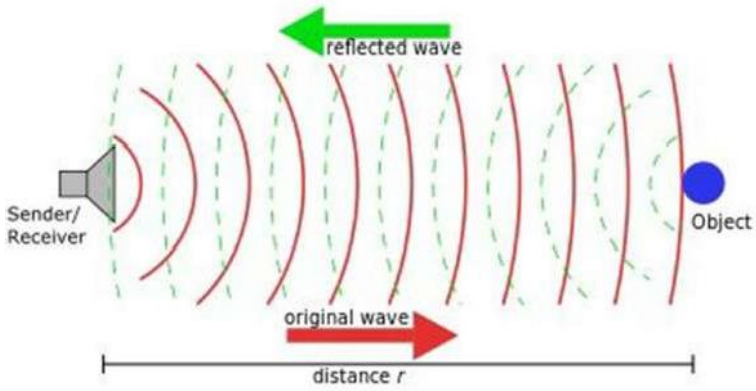

Figure 8 - Principles of Ultrasonography

Ultrasound Tissue Interaction:

As the ultrasound waves travel through tissues, they are partly transmitted to deeper structures, partly reflected back to the transducer as echoes, partly scattered, and partly transformed to heat.

Reflection

For image generation, the echoes returned after hitting a tissue interface is of interestto us. The amount of echo returned after hitting a tissue interface is determined by a tissue property called acoustic impedance. The intensity of a reflected echo is proportional to the mismatch in acoustic impedances between two mediums.

Refraction

The change in the direction of the ultrasound waves after hitting an interface between two media with different velocities of sound transmission is refraction. This causes artefacts as the returning echoes are incorrectly located.

Scattering

Ultrasound waves which incident on the tissues at right angles are reflected back to the transducer. If the waves are not at right angle, then the returning echoes are scattered in all directions in a non-uniform manner

Absorption

Some of the ultrasound waves are absorbed by the tissue and are converted to heat.

Attenuation

As the ultrasound waves travel through tissue, the returning echoes will become weaker due to absorption, scattering and refraction.

Diffraction

The spreading out of the ultrasound waves as its moves further away from the source is diffraction.

Construction

The ultrasound probe has an array of individual transducers which acts as both a transmitter and a receiver. Each transducer emits a short burst of ultrasound and is quiescent until it detects the echoes returning. This is called “Pulsed Ultrasound”. The speed of ultrasound in our body tissues is fairly constant at a speed of 1540m/s. The time taken for an echo to return is used determine the distance between the tissue andthe probe.

Across the plane of an image, the ultrasound image is swept to form two dimensional images one line at a time. These lines are then summated to produce a frame. The

frames are repeated to produce a real-time image. The brightness of the image depends upon the amplitude of the returning echo from the anatomical interfaces.

Scanning Modes

A-mode (amplitude mode): This displays a single echo signal against time to measure depth.

B-mode (brightness mode): It is a two dimensional image produced using an array of transducers and a series of reflected echoes.

M-mode (motion mode): is a specialized type of B-mode imaging where one particular line is ensonified repeatedly to examine a moving structure plotting out how the structure moves with time.

Ultrasound controls

Gain alters the brightness of the image by amplifying the received signal.

Time-Gain Compensation (TGC) differentially amplifies signals from different depths, allowing equal amplitudes from all depths to be displayed.

Focus adjusts the beam to be at its narrowest at the required depth to image the region of interest. It thereby improves lateral resolution

Depth can be adjusted to have the structure that is being examined to be in the centre of the screen.

Approaches and techniques

There are two basic approaches to ultrasound guidance. With the out-of- plane technique, the needle tip crosses the plane of imaging as an echogenic dot. With the in-plane approach, the entire tip and shaft of the advancing needle are visible.

Out-of-plane:

This technique involves insertion of needle at the midpoint of probe such that theneedle cuts across the ultrasonic beam. The image obtained is a cross section of the needle shaft or tip. Path to target is shorter as compared to in-plane technique, but visibility of needle is not optimum, indirect markers like tissue movement or hydrodissection is needed to confirm placement.

Advantages:

1) Most similar to other approaches to regional block (nerve stimulation or palpation)

2) Shorter needle path than with in-plane approaches

3) Along the nerve path (catheters)

Disadvantages:

Unimaged needle path, crossing the plane of imaging without recognition.

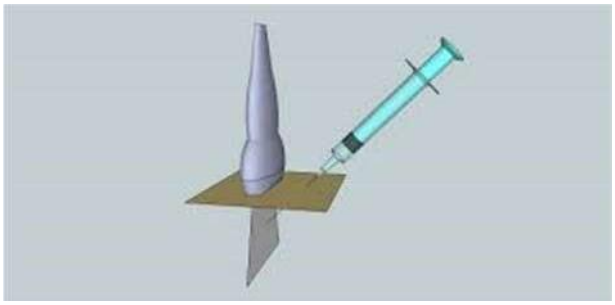

Figure 9 - Out of plane approach

In-plane (IP):

In this technique needle is inserted along the length of ultrasound probe. It aligns the entire length of the beam with the shaft of needle. The image displayed will depict the entire needle shaft and its tip thereby improving the precision of nerve blocks. But the needle visibility depends on angle of insertion and the needle traverses a longer pathto reach the target area.

Advantages:

Most direct visualization.

Disadvantages:

1) Partial line-ups (creating a false sense of security when the needle tip is not correctly identified.

2) Some unimaged needle path occurs with IP approach, but typically less than with OOP approach.

3) Longer paths and therefore more structures to cross with the block needle.

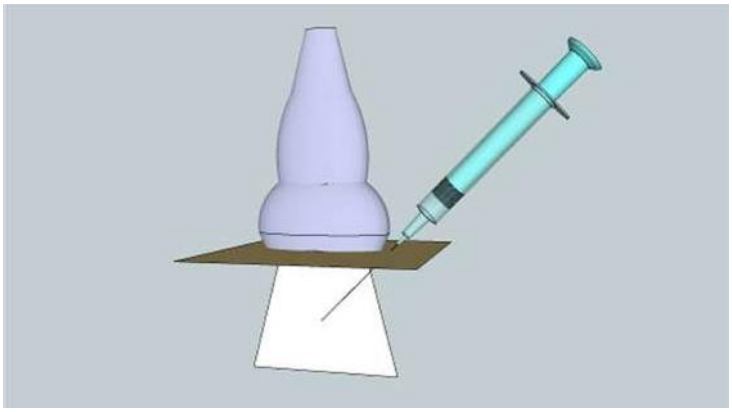

Figure 10 - Inplane approach of ultrasonography

Ultrasound probes

Commonly used are three types

- Linear high frequency (6 to 12 MHz) probes which has high resolution and lesser penetration and is ideal for visualizing superficial structures.

- Curvilinear low frequency probes (2-5MHz) which has low resolution, higher penetration and is ideal for deeper structures like intraabdominal organs.

- Phased Array Probe also has low frequency (2MHz – 7.5MHz) gives a large depth with a small acoustic window, ideal for chest ultrasound

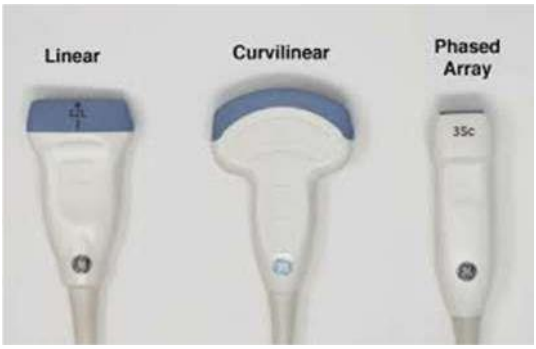

Figure 11 - Ultrasound probes

Imaging

Ultrasound image is produced by echoes received as the Ultrasonic beam interactswith the tissues it travels through. Acoustic impedance of a structure is the function of the elasticity and density of the particular tissue. Materials with higher acoustic impedance transmit sound faster, and do not allow for continued compression by the impending wave. The sound beam is attenuated while traversing various tissues within the body. The beam will be scattered somewhat when it encounters varying tissues on the way with different acoustic impedances or it may be reflected back from structures and returns back to the transducer. Refraction and absorption by tissues may also attenuate the waves. Those tissues that reflect the wave are termed echoic and those which do not reflect the wave are termed anechoic. Always use plenty of sterile ultrasound gel to remove the air interface between the skin and probe. Air does not allow the passage of the ultrasound beam even though it has low Acoustic impedance. Bone has high acoustic index so it appears to be white on the ultrasound image as it is hyper reflective to the beam. Blood and other fluids appear to be black on the image since they are anechoic in nature. Soft tissue appears as grey on the sonographic image as they have medium echogenicity.

The nerves appear round or oval in transverse view and are hypo-echoic or they appear as honeycomb structures with septations inside them. Nerves are bordered by a hyper-echoic layer of connective tissue. Blood vessels will appear as circular hypoechoic to anechoiec structures with a well-defined hyper- echoic border which isthe vessel wall. Veins are compressible with thinner walls whereas arteries have thicker walls and appear pulsatile in nature. Muscles have fibrous-lamellar texture and

appear as heterogeneous or homogeneous hypoechoic structures with hyper-echoic septa in between.

Basic principles of ultrasound guided nerve blocks.

- First involves the identification of anatomical structures like muscles, fascia, blood vessels and bones.

- Visualization of the nerve plexus or the fascial plane where drug should be deposited.

- Should be able to differentiate between normal and altered anatomy of the region scanned.

- Identify the correct plane for needle insertion to avoid trauma to vessels

- Strict aseptic technique

- Real time visualization of needle when it is inserted inside.

-Once the target is reached, inject a small volume of drug or saline and see the spread and confirm location, else reposition the needle.

- Do frequent aspiration during injection of drug to rule out intravascular injection.

- Complete visualization of the spread of total volume of local anaesthetic drug injected.

- Always keep ready all resuscitation equipment, drugs and standard monitoring.

ULTRASOUND ANATOMY OF INGUINAL CREASE AREA

Within the pelvis, the fascia iliaca is located to the IM. In their intrapelvic path, the femoral and lateral cutaneous nerve of the thigh both pass through the fascia iliaca. Identifying the femoral artery (FA) at the level of the inguinal crease is the first step inin anatomical orientation. If the vessel isn't visible right away, shifting the transducer medially and laterally will ultimately reveal it. The iliopsoas muscle is a big hypoechoic tissue immediately lateral and deep to the FA and femoral vein. It's surrounded by a hypoechoic fascia, which can be observed separating the muscle from the superficial subcutaneous tissue.

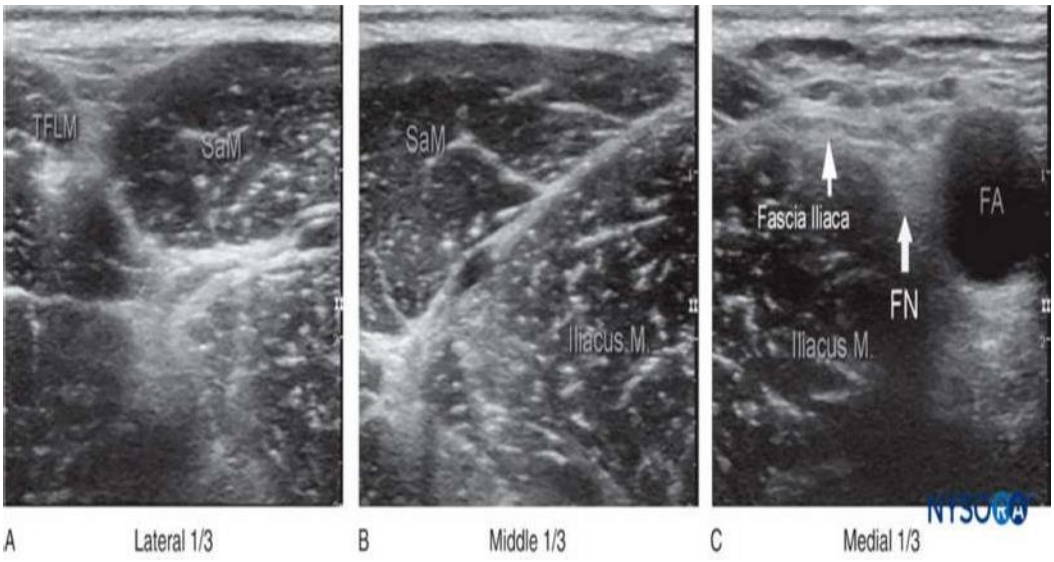

Figure 12 - Ultrasound anatomy of the inguinal crease area. From lateral to medial, shown are the tensor fasciae lata muscle (TFLM), SM, Iliaca muscle, Fascia Iliaca, Femoral nerve (FN) and Femoral artery (FA)

The hyperechoic FN should be visualised wedged lateral to the FA between the iliopsoas muscle and the fascia iliaca. The SM, which is covered by its fascia, as well

as the fascia iliaca, are visible as the transducer is moved laterally. The ASIS can be seen by moving the transducer to the side. [22]

PENG BLOCK

The PENG block is a regional anaesthetic technique described in 2018 for postoperative analgesia incomplete hip arthroplasties with motor sparing benefits. By depositing LA inside, the myofascial plane of the psoas muscle and superior pubic ramus, the block is supposed to offer more comprehensive analgesia to the hip.

The ultraound probe is placed on a transverse plane above the ASIS while the patient is supine. The transducer is positioned with thepubic ramus and turned at roughly 45º, parallel to the inguinal crease once the ASIS has been found. The transducer is then slid medially along this axis until the Anterior inferior iliac spine (AIIS), IPE, and psoas tendon can all be seen clearly.

In the palne between the psoas tendon and the pubic ramus, a standard 20-22 gauge 100mm needle is inserted in-plane, from lateral to medial. The psoas tendon is then lifted using 15-20 ml of a long-lasting LA injected into this plane. Puncturing the psoas tendon should be avoided at all costs. [23]

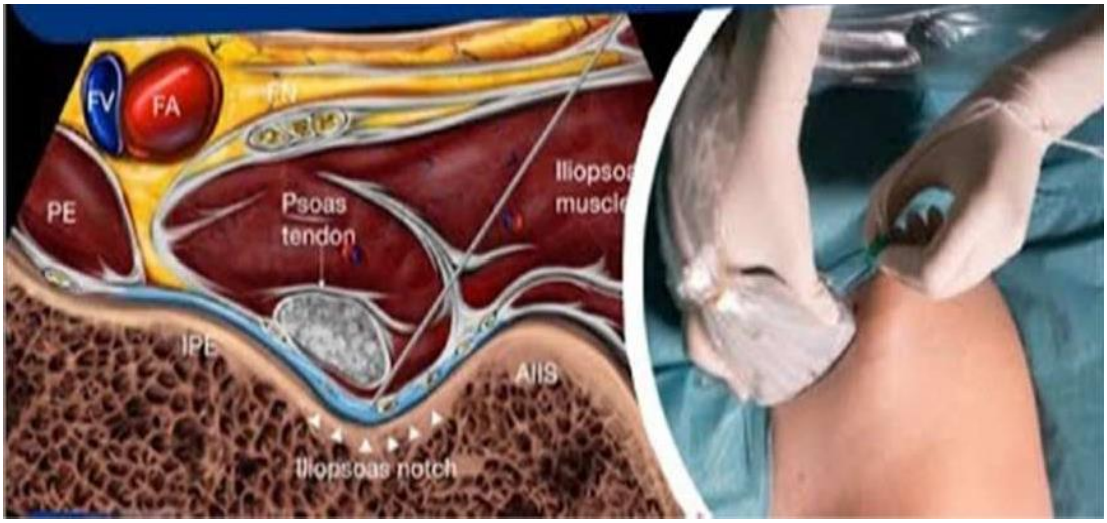

Figure 13 - Ultrasound anatomy and probe position for PENG block

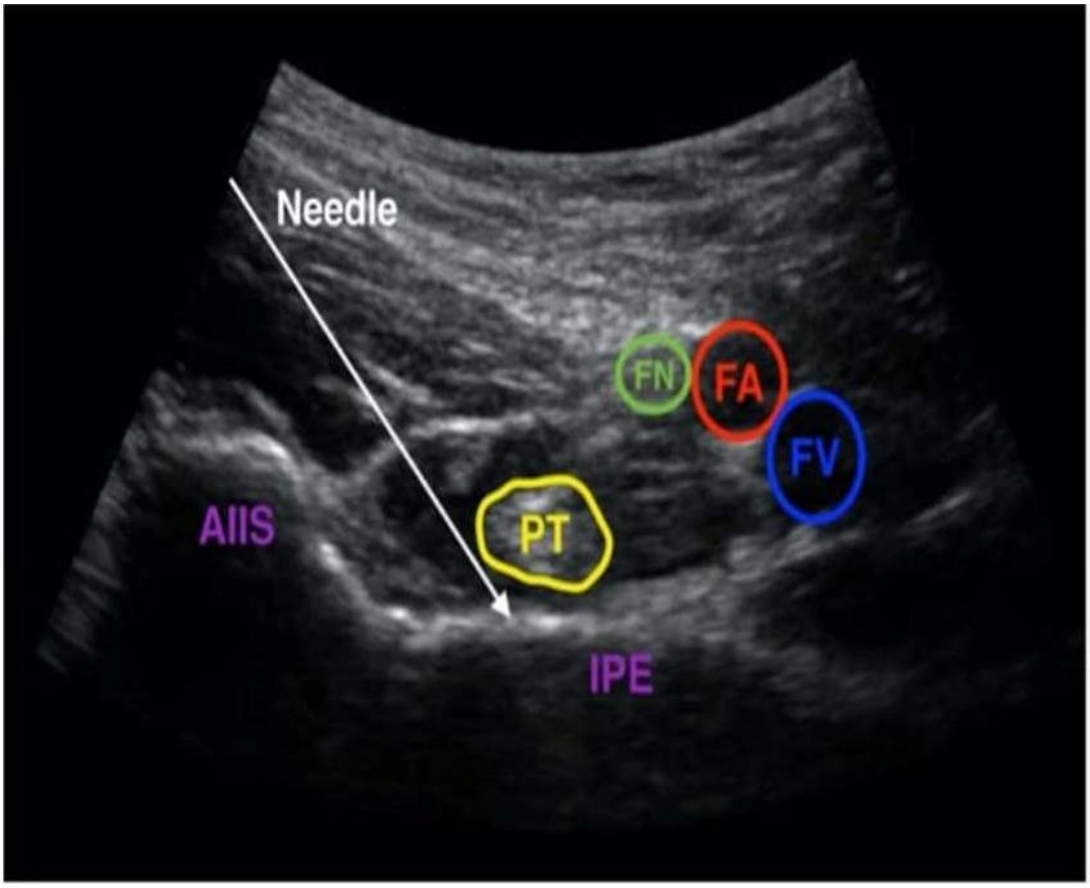

Figure 14 - The position of the needle

FICB

The patient is positioned supine with the extended hip and the ultrasound probe isplaced perpendicular to the inguinal ligament slightly inferior and medial to the ASIS. A high frequency linear ultrasound probe is usually suitable, while for obese patients, a lower frequency curved probe may be preferable.

The hyperechoic fascia iliaca is seen on the muscle's superficial border, while the IM is found superficial to the ilium. The inguinal ligament is visible just under the fascia iliaca, where the abdominal wall muscles meet those of the lower extremities. At the level of the AIIS, the tapering confluence of the internal oblique (cephalad) and theSM (caudad) at the inguinal ligament has been described as a bow tie sitting on the IM.

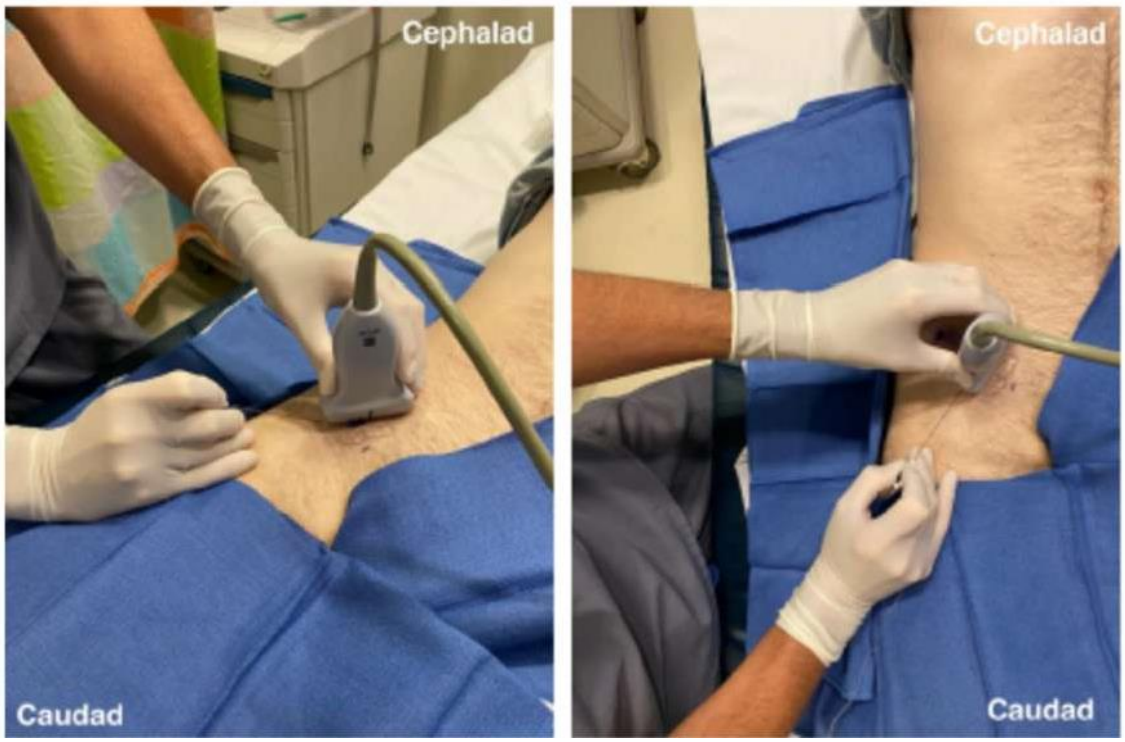

Figure 15 - Transducer position for FICB

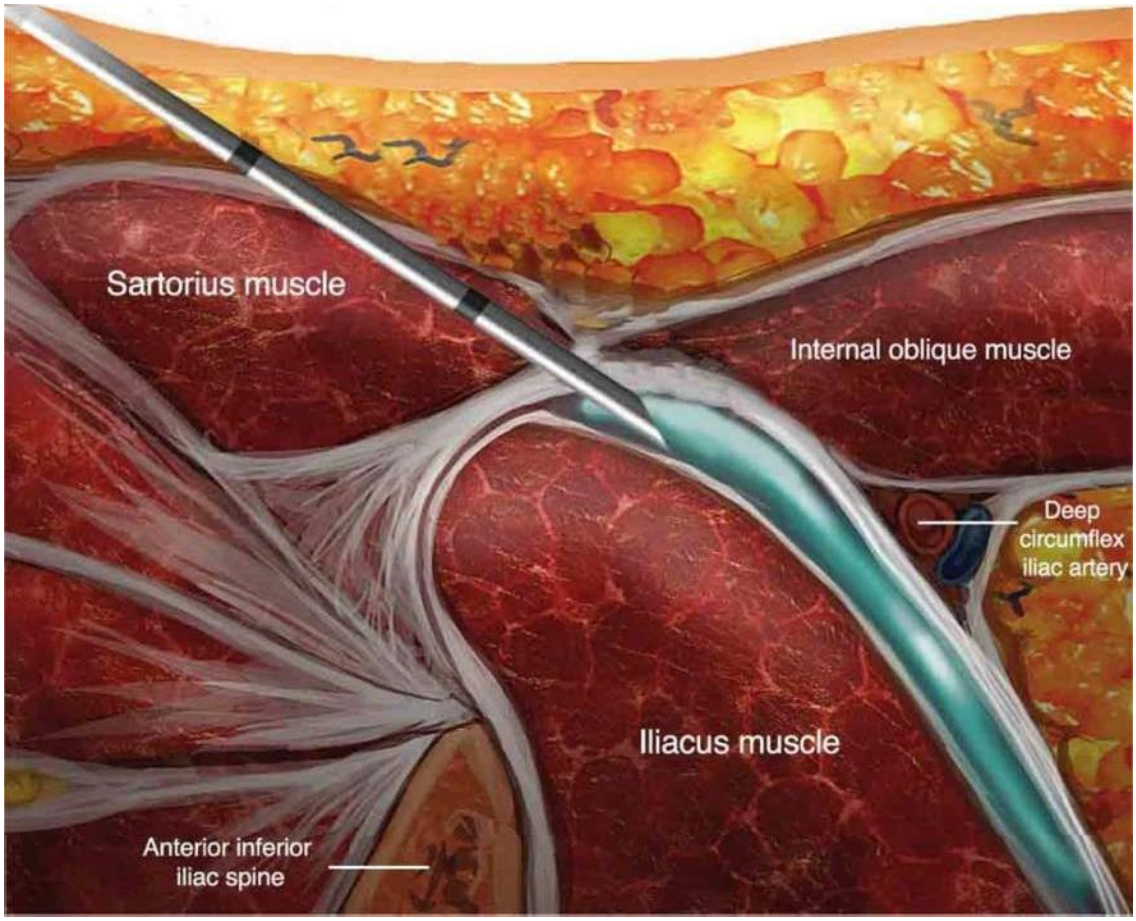

Figure 16- cross section image of the probe position

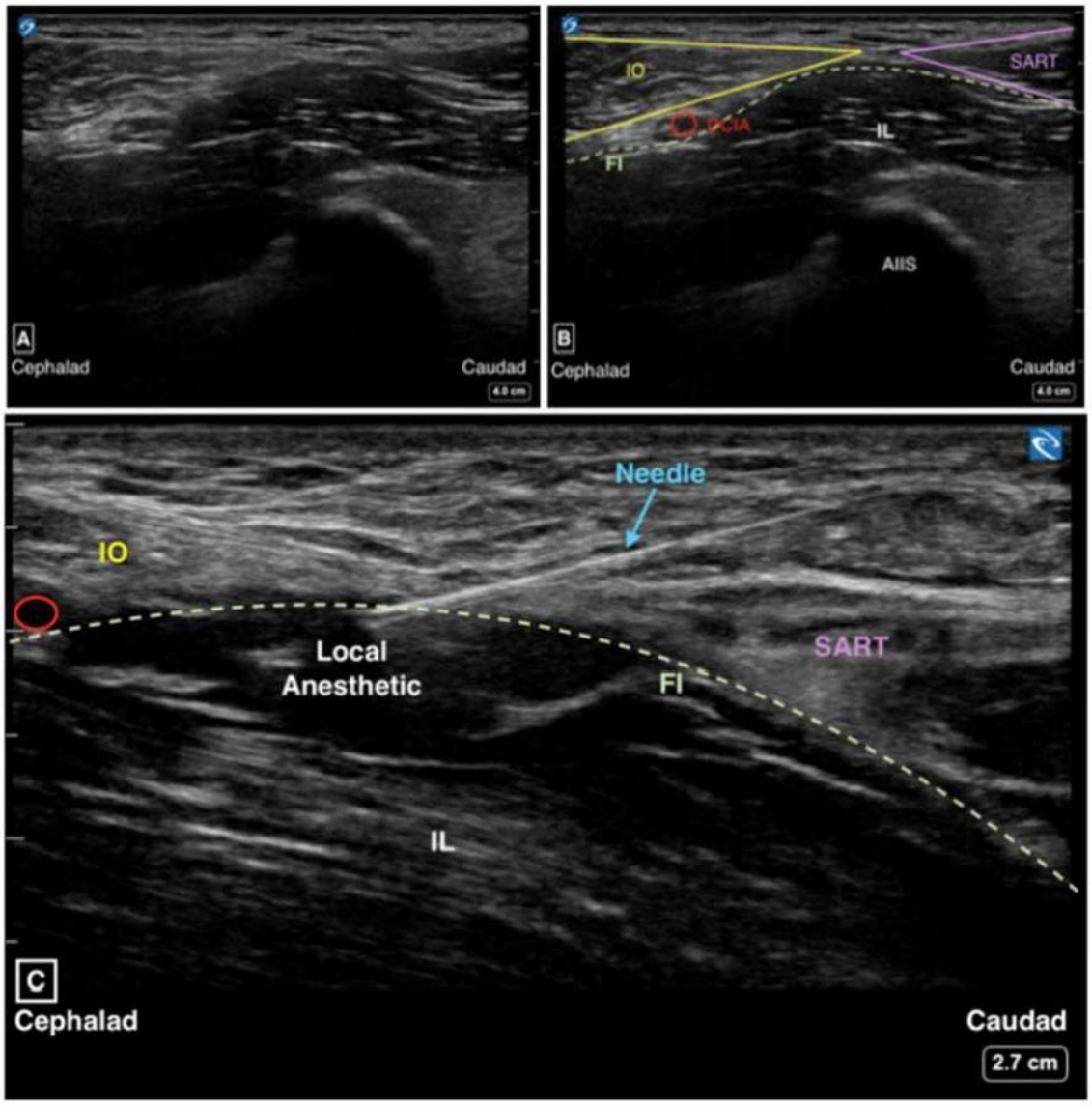

Figure 17- The "bow-tie" appearance of the internal oblique and SM in (B). In (C), the block needle can be seen piercing the fascia iliaca

From the inferior aspect of the probe, a stimuplex needle is introduced using an in- plane approach. The needle may need to be retracted slighlty after the "pop" through the fascia ilaica to rest at the superficial boundary of the iliacus. The hyperechoic fascia iliaca and more heterogenous IM underlying it are then confirmed by injecting 1-2ml of saline or LA. As the IM is hydraulically dissected away from the overlying

fascia iliaca, the needle is inserted farther into the pocket of LA , progressing in the cephalad direction. To open this poterntial area and reach the target nerves, approximately 30-40ml of fluid is normally required. [24]

ROPIVACAINE [25] [26]

Introduction

Ropivacaine is a newer, longer acting local anaesthetic agent which belongs to the amino amide group. It was first synthesized by Ekenstam in 1957; however it was first introduced for clinical practice only since 1996. Chemically it belongs to the same group as bupivacaine and mepivacainei. epipecoloxylidide local anaesthetic.

It was found that butyl derivatives of pipecoloxylidides (example bupivacaine) were more cardiotoxic than propyl derivatives, causing a significant number of cardiac arrests.25

Thus ropivacaine was developed as a pure S – enantiomeric form of pipecoloxylidides. Though ropivacaine has been available internationally for over three decades, it is a relative new entrant in the Indian market.

It is becoming increasingly popular among anaesthesiologists and has beenused extensively in almost all modes of regional anaesthesia: infiltration, peripheral nerve blocks, spinal anaesthesia, epidural anaesthesia as well as caudal epidural blocks in paediatric patients.

Chemical Structure

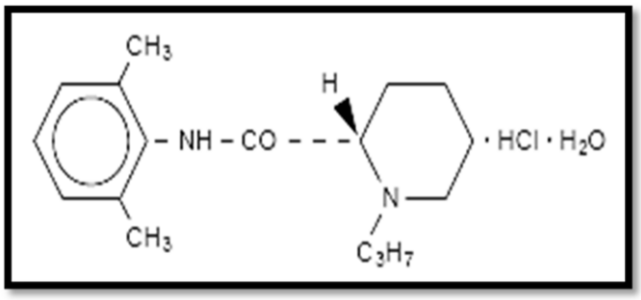

Figure 18 - Chemical structure of ropivacaine

Ropivacaine is an amino amide local anaesthetic agent, chemically described as S-(-)-1-propyl-2',6'-pipecoloxylidide hydrochloride monohydrate. The International Union of Pure and Applied Chemistry name is (S)-N-(2,6-dimethylphenyl) -1-propylpiperidine-2-carboxamide. It's molecular formula is C17H26N2O•HCl•H2O and it has a molecular weight of 328.89.

Ropivacaine is a white crystalline powder. At 25°C ropivacaine hydrochloride has a solubility of 53.8 mg/mL in water and a distribution ratio between n-octanol and phosphate buffer at pH 7.4 of 14:1. The pKa of ropivacaine is 8.07 which is very similar to that of bupivacaine (8.1) .

However, ropivacaine has a much lesser lipid solubility as compared to bupivacaine and mepivacaine. This can be explained on the basis of presence of a propyl (3 Carbon) side chain in ropivacaine as compared to a butyl (4 Carbon) side chain in the other two local anaesthetics. This lower lipid solubility Physical Properties of ropivacaine has a significant effect on the block characteristics of ropivacaine as discussed ahead.

Mechanism Of Action And Corelation With Structure

Ropivacaine reversibly inhibits the voltage gated sodium channels present on the nerve cell membranes thus preventing the influx of sodium ions into the cells. This:

i. Block generation and conductance of nerve impulses.
ii. Slows propagation of nerve impulses
iii. Reduces the rate of rise of action potential

Almost all local anaesthetic agents block the unmyelinated C and myelinated Aδfibres, which transmit pain impulses, at the same rate.

The rate of blockade of motor fibres (Aα and Aβ), however depends upon the physio chemical properties like pKa and lipid solubility of the individual drug. As ropivacaine is less lipid soluble than bupivacaine, the Aα and Aβ blockade is slower and hence motor blockade is less potent. Studies of lumbar epidural block in humans have confirmed that equal volumes and concentrations of bupivacaine and ropivacaine produce similar degree of sensory block but the motor block produced by ropivacaineis slower in onset, lesser in intensity and shorter in duration.

Clinically the order of blockade of nerve fibres is autonomic, sensory and motor, while the regression of the block occurs in reverse order.

The nerve impulse transmission is lost in the following order:

The order of the loss of nerve function is

1. Pain
2. Temperature

3. Touch
4. Proprioception
5. Skeletal muscle tone.

Pharmacokinetics

Absorption :

The systemic concentration of ropivacaine depends on the total dose and concentration of drug given, the route of administration, the patient's haemodynamic state and the vascularity of the site of administration. When administered in the epidural space, ropivacaine has a biphasic absorption. The half-lives of the two phases(mean+ SD) are 14+7 minutes and 4.2 +0.9 hours respectively.

Distribution :

After intravascular infusion, ropivacaine has a steady state of distribution of 41 ± 7 litres. It is 94% protein bound, mainly to α1-acid glycoprotein. In case of continuous epidural infusion of ropivacaine the plasma concentration can rise due to increased protein binding and reduced clearance. Ropivacaine can easily cross the placenta.

Metabolism and excretion :

Ropivacaine is extensively metabolized by the liver, predominantly by the cytochrome P4501A mediated aromatic hydroxylation to produce 3 – hydroxyl ropivacaine. After a single IV dose, approximately 37% of the total dose is excreted in the urine as both free and conjugated 3-hydroxy ropivacaine. An additional

unquantified amount of 2 – hydroxyl – methyl ropivacaine has also been identified s a metabolite.

Ropivacaine metabolites are mainly excreted via kidney. After i.v. administration 86% of the dose is excreted in urine of which only 1% is in unchanged form. Following IV administration, ropivacaine has a mean ± SD total plasma clearance of 387 ± 107 mL/min, an unbound plasma clearance of 7.2 ± 1.6 L/min anda renal clearance of 1 mL/min. The mean ± SD terminal half life is 1.8 ± 0.7 h and 4.2
±1.0 h after i.v. and epidural administration respectively.

Pharmacodynamics

Central Nervous System &CardioVascularSystem :

Ropivacaine has a higher threshold for both cardiac as well as neuro toxicity as compared to bupivacaine due to its lower lipid solubility and stereo - selective properties. This holds good for both isomers of ropivacaine which have been shown to be less cardio depressant than respective bupivacaine isomers in animal studies.

CNS toxicity occurs earlier than cardiac toxicity on iv infusion in healthy volunteers.

Potency :

Lipid solubility of a local anaesthetic correlates well with its potency and toxicity. Compounds which are more lipophilic penetrate the nerve cell membrane more readily. Thus, fewer molecules are required to produce the desired conduction blockade.

Others :

Continuous epidural infusion of 0.375 % and 0.188% ropivacaine has been shown to inhibit platelet aggregation in plasma.

Adverse Effects

Excessive plasma levels are due to over dosage, unintentional intravascular injection or slow metabolic degradation. The mean doses at which CNS symptoms of toxicity begin to occur in human beings are 4.3 and 0.6 mcg/mL of total and free plasma concentrations respectively. When prolonged blocks are used the risks of reaching a toxic plasma concentration or inducing local neural injury are increased.

Various possible side effects include

a) Injection site pain
b) Cardiovascular system toxicity: Vasovagal reaction, syncope, postural hypotension, non-specific ECG abnormalities which include wide QRS complexes, increased conduction time and reduced contractility.
c) Gastrointestinal system toxicity: Faecal incontinence, tenesmus, nausea, vomiting.
d) Central nervous system toxicity: Tremor, Horner's syndrome, dyskinesia, neuropathy, vertigo, convulsion and coma. Because of depressant effect of ropivacaine on medulla, excitatory stage of CNS might not occur.
e) Liver and Biliary system toxicity: Jaundice
f) Metabolic disorders: Hypomagnesemia

Advantages Over Other Local Anaesthetics

Ropivacaine produces a more differential blockade allowing better separation between sensory and motor block and is therefore a better choice for use in labour analgesia and post operative pain relief. When compared to bupivacaine it produces less dense motor blockade of shorter duration and hence permits earlier mobilization and discharge thus reducing both morbidity as well as cost of treatment. It has a lower systemic toxicity than bupivacaine and a better, cardio stable profile. Ropivacaine has been developed to offer a safer alternative to bupivacaine while retaining the desirable blocking properties of racemic bupivacaine.

METHODOLOGY

Source of Data: Patient regardless of gender and age 18 years and above , who belong to ASA grade I and II, undergoing proximal femur fracture procedure under subaranchnoid block at KLE's Dr. Prabhakar Kore Hospital And Medical Research Centre, Nehru Nagar, Belagavi 590010.

Study Design: RCT.

Study Period: August 2022 - September 2023

Sample Size: 60

Sample size formula: The minimum sample size formula based on mean and standard deviation is

$$n = \frac{(z_\alpha + z_\beta)^2 (s_1^2 + s_2^2)}{(\bar{X}_1 - \bar{X}_2)^2}$$

where zα is linked with the level of significance and zβ is linked with the power of the test. For 5% level of the significance zα =1.96 and zβ =0.84 for 80% power of the test. The parameter considered in the calculation is the Visual Analogue Scale [27]

x_1 is the mean of the first group (5.7) and x_2 is the mean of the second group (6.0).

s_1 is the standard deviation of the first group (0.3) and s_2 is the standard deviation of the second group (0.5).

With the values above sample size obtained is 60.

There were two groups with 30 cases in each group.

Sampling technique: Following fulfilment of inclusion and exclusion criteria and acquiring informed consent. A computer-generated random number table was used to randomly select patients into two groups.

- Group P received PENG block
- Group F received FIC block

Inclusion Criteria:

- Age 18 years and above.
- Patients undergoing fixation of femur fractures surgeries under spinal anaesthesia
- Either sex .
- ASA grades I & II.
- Patients willing to give informed consent.

Exclusion Criteria:

- Hypersensitivity to local anaesthesia.
- Pre-existing respiratory, cardiovascular, neurological, renal disorders.
- Alcohol or drug abuse.
- Patients who do not fulfil inclusion criteria.

Study protocol: After obtaining the approval of ethical committee and acquiring informed consent, total of 60 patients undergoing surgical procedure under subarachnoid block were included in the study.

PROCEDURE :

After confirming NBM status, prior to the block, a wide bore 18G cannula secured ,VAS scale was used to assess pain and vitals were monitored. Block was given 30 minutes before shifting to the operation room.

Group P received PENG block with 0.75% Ropivacaine (15ml).

Group F received FIC block with 0.75% Ropivacaine (15ml).

Pain was assessed after making the patient to sit using VAS.

Pain scores and easiness of positioning for spinal anaesthesia were assessed.

The post-block pain score was assessed every 5 minutes interval for 30 minutes.

If the VAS score was more than 4, rescue analgesia in the form of IV Paracetamol-15mg/kg body weight was given.

VAS was explained to the patient. VAS is a subjective measure on a scale of ten which represents “no pain” and “worst pain”. It is a pain rating scale from one to ten. A VAS is a psychometric response scale that is used to gauge attitudes or subjective traits that are difficult to quantify. It is often used in clinical,research settings to assess pain intensity, mood, anxiety, and other variables that are difficult to quantify objectively. Typically, the VAS is a fixed length, straight horizontal line thatis typically 10cm or 100mm in length anchored by two extremes of the phenomenon being measured. The endpoints are labeled with the minimum and maximum values, such as "no pain" to "worst pain imaginable" for pain measurement. The patient is instructed to place a mark on the line that they believe best captures their conditions.

Easy to administer and understand. More sensitive to changes in the patient's condition compared to categorical scales. Most commonly used for assessing painintensity. The score obtained from the VAS is considered a continuous variable, which allows for more nuanced statistical analysis and can provide a detailed picture of the patient's condition or the effect of an intervention. The VAS is a straightforward and effective tool for measuring subjective experiences.

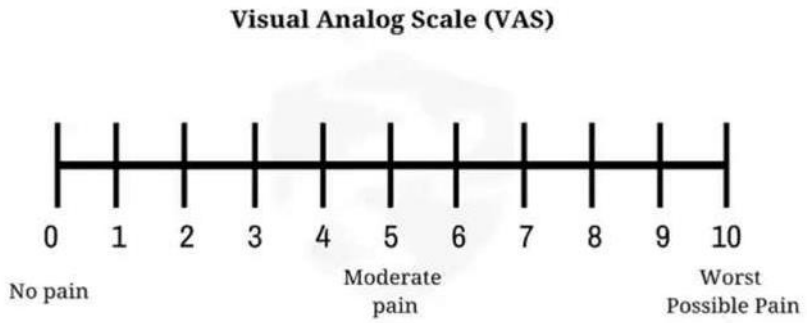

Figure 19- Visual Analogue Scale

Hemodynamic responses like Pulse Oximeter (SpO2), Blood pressure (BP), Pulse rate (PR), Respiratory rate(RR) were monitored and noted throughout the procedure.

An independent consultant anaesthesiologist performed the blocks who wasnot involved in the study . Pain on positioning was assessed every five minutes forthirty minutes using VAS scale. Hemodynamic parameter were recorded at desired intervals.

PENG block technique:

A 15ml of 0.75% Ropivacaine was prepared and kept ready. Using a low-frequency linear ultrasound transducer (6-13mHz) on the proximal thigh, parallel to

and next to the inguinal crease, the patient was put in a supine position . Probe turned 45º to locate psoas tendon, iliopubic eminence and anterior inferior iliac spine. In an in-plane approach an echogenic needle 23 gauge was inserted and placed the tip in musculofascial plane employing the hydrodissection technique, between the Pubic ramus and the Psoas tendon . A total of 15ml of 0.75% Ropivacaine administered after negative aspiration.

FICB technique:

The linear ultrasound probe (6–13 mHz) (sonosite) was positioned inferiorly medially to the ASIS, over the inguinal ligament, in the FICB group. An echogenic needle 23 gauge was placed one cm cephalad to insert the needle tip into the inguinal ligament between the internal oblique and iliacus muscles by hydrodissection technique after recognizing the "bow-tie sign" created by the internal oblique muscle and the sartorius by turning and moving medially. After negative aspiration, a total of15 mL of 0.75% ropivacaine was administered.

STATISTICAL ANALYSIS

Calculating the mean and standard deviation of continuous quantitative data. Rates, ratios and percentages were used to determine the categorical data.

The Chi-square test employed to examine the relationship between groups and categorical variables .

The distribution of variables among groups was compared using Mann-Whitney U test.

Friedman test was used to evaluate how the variables are distributed among the groups.

The comparison was represented using the appropriate graphs.

A value of p less than or equal to 0.05 was deemed to be statistical significant for each test.

RESULTS

Data contains measurements on 60 subjects which are divided into 2 groups of 30 subjects each. The following table gives the comparison of demographic details over groups.

Table 1: Comparison of demographic details over groups.

Variables	Sub Category	Group P	Group F	Total	p-value
Age (years)	Mean ± SD Median (Min, Max)	67.47 ± 14.63 70.5 (19, 94)	64.43 ± 15.36 68 (27, 87)	65.95 ± 14.95 70 (19, 94)	0.5439[MW]
Sex	Female	15 (50%)	15 (50%)	30 (50%)	1[C]
	Male	15 (50%)	15 (50%)	30 (50%)	

Abbreviation: MW – Mann Whitney U test, C – Chi square test.

In terms of age, Group P has a mean age of 67.47 years with a standard deviation of 14.63, while Group F has a slightly lower mean age of 64.43 years with a standard deviation of 15.36. However, two groups mean ages differ by a non-statistically insignificant amount (p-value =0.5439).

Regarding gender distribution, both groups have an equal distribution of females and males, with 50% females and 50% males in each group. The results of the Chi-square test show that there is no statistical difference in both the groups under gender distribution (p-value = 1).

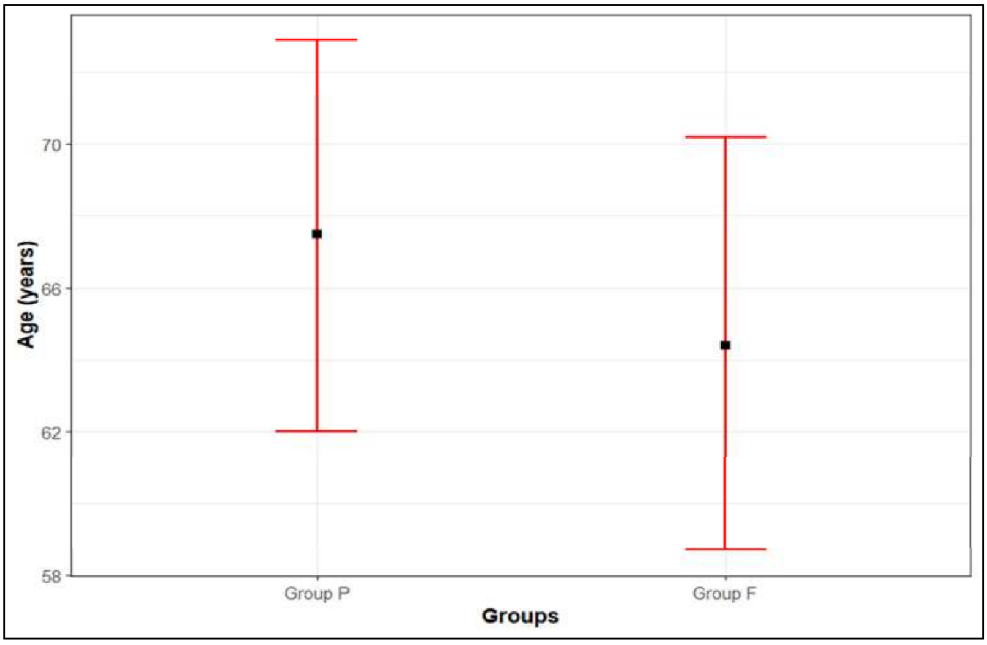

Figure 1: Mean plot of age over groups.

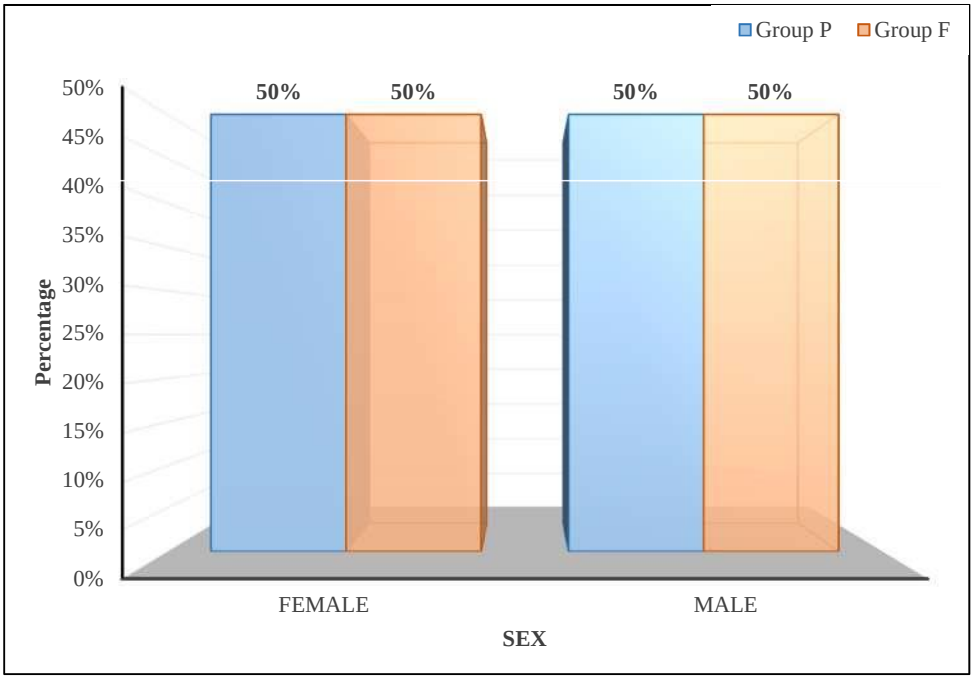

Figure 2: Distribution of sex over groups.

The following table gives the comparison of clinical parameters over groups.

Table 2: Comparison of clinical parameters over groups.

Variables	Sub Category	Group P	Group F	Total	p-value
Temperature	Afebrile	30 (100%)	28 (93.33%)	58 (96.67%)	0.5047^{MC}
	Febrile	0	2 (6.67%)	2 (3.33%)	
ASA grade	1	9 (30%)	12 (40%)	21 (35%)	0.4168^{C}
	2	21 (70%)	18 (60%)	39 (65%)	
Rescue analgesia	Nil	30 (100%)	30 (100%)	60 (100%)	1^{C}

Abbreviation: C – Chi square test, MC – Chi square test with Monte Carlo simulation.

For temperature, all patients in Group P (100%) were afebrile, while 93.33% in Group F were afebrile and 6.67% were febrile. From Chi-square test, it is noted that this difference is not statistically significant (p-value = 0.5047). Regarding ASA grade, 30% of patients in Group P were classified as grade 1 and 70% as grade 2, compared to 40% and 60% in Group F, respectively. From Chi-square test, results show that there isn't a statistically significant difference in ASA grade distribution between the groups (p-value = 0.4168). Finally, both groups did not require rescue analgesia, with all patients (100%) reporting no need for it, indicating no significant difference (p-value = 1).

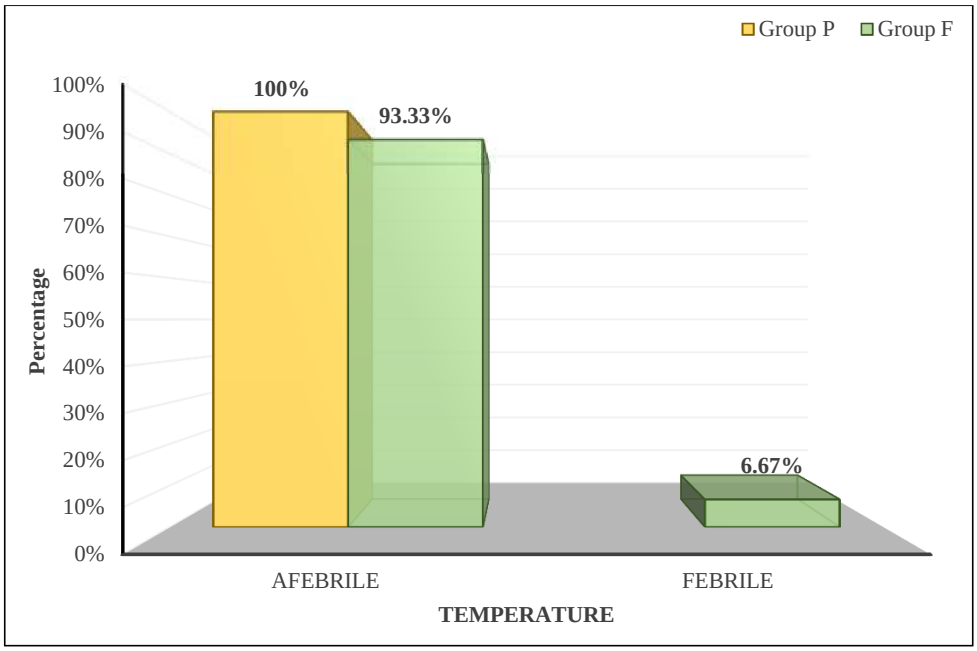

Figure 3: Distribution of temperature over groups.

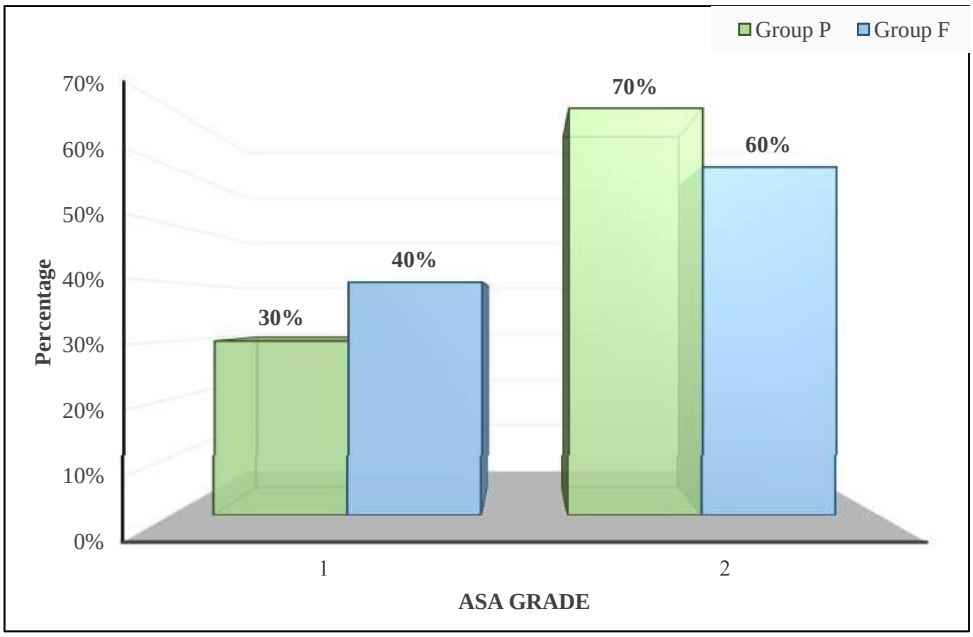

Figure 4: Distribution of ASA grade over groups.

The following table gives the comparison of VAS scale over time and group.

Table 3: Comparison of Visual Analog Score over time and group.

Visual Analog Score	**Group P**	**Group F**	**Total**	**p-value**
Before block	6.9 ± 0.55 7 (4, 7)	6.9 ± 0.55 7 (4, 7)	6.9 ± 0.54 7 (4, 7)	0.9999^{MW}
After 5 mins of block	6 ± 1.44 7 (4, 7)	5.7 ± 1.51 7 (4, 7)	5.85 ± 1.47 7 (4, 7)	0.4296^{MW}
After 10 mins of block	4.3 ± 1.21 4 (1, 7)	4.6 ± 1.22 4 (4, 7)	4.45 ± 1.21 4 (1, 7)	0.3551^{MW}
After 15 mins of block	2.9 ± 1.47 4 (1, 4)	3 ± 1.82 4 (1, 7)	2.95 ± 1.64 4 (1, 7)	0.9454^{MW}
After 20 mins of block	2.1 ± 1.47 1 (1, 4)	1.5 ± 1.14 1 (1, 4)	1.8 ± 1.34 1 (1, 4)	0.0824^{MW}
After 25 mins of block	1.4 ± 1.04 1 (1, 4)	1.3 ± 0.92 1 (1, 4)	1.35 ± 0.97 1 (1, 4)	0.6901^{MW}
After 30 mins of block	1.5 ± 1.07 1 (1, 4)	1.47 ± 0.97 1 (1, 4)	1.48 ± 1.02 1 (1, 4)	0.8533^{MW}
p-value	**< 0.001^{F}***	**< 0.001^{F}***	-	-

*Abbreviation: MW – Mann Whitney U test, F – Friedman's test, * indicates statistical significance.*

Friedman's test showed a statistically significant reduction in VAS over time within each group (p-value < 0.001), indicating that the block effectively reduced pain levels in both groups over time. However, there were no discernible differences in pain reduction in both the grou according to the Mann-Whitney U test at any specific time point, suggesting that both treatments were similarly effective.

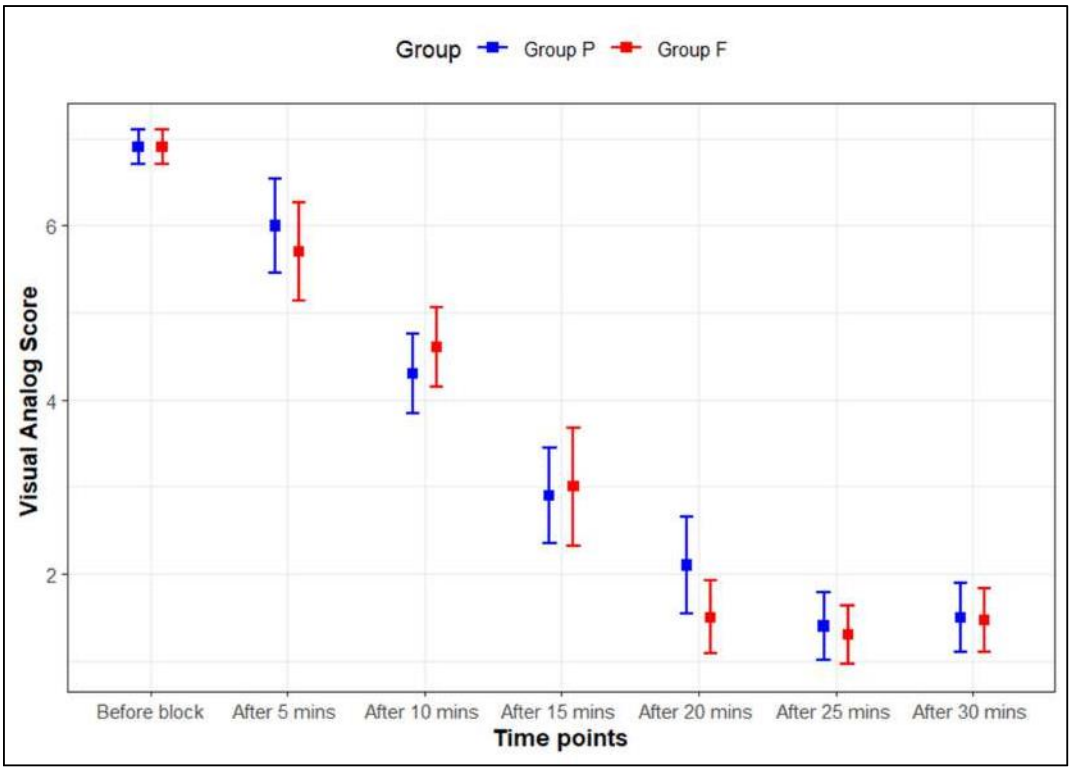

Figure 5: Mean plot of VAS over time and groups.

The following table gives the comparison of SBP over time and groups.

Table 4: Comparison of SBP over time and groups.

SBP	Group P	Group F	Total	p-value
Before block	138.6 ± 23.52 131 (110, 220)	135.07 ± 13.48 132 (110, 160)	136.83 ± 19.09 131 (110, 220)	0.8754[MW]
After 5 mins of block	127 ± 19.85 123 (92, 170)	127.2 ± 14.46 130 (100, 160)	127.1 ± 17.22 127 (92, 170)	0.9646[t]
After 10 mins of block	119.07 ± 21.36 118 (90, 166)	119.87 ± 14.44 120 (94, 154)	119.47 ± 18.08 118 (90, 166)	0.5099[MW]
After 15 mins of block	111.73 ± 18.74 107 (90, 160)	112.87 ± 15.4 110 (90, 154)	112.3 ± 17.02 108 (90, 160)	0.4319[MW]
After 20 mins of block	108.6 ± 17.64 101 (90, 160)	109.67 ± 15.97 104 (90, 150)	109.13 ± 16.69 103 (90, 160)	0.5629[MW]
p-value	**< 0.001[F]***	**< 0.001[F]***	-	-

*Abbreviation: t – Two sample t test, MW – Mann Whitney U test, F – Friedman's test, * indicates statistical significance.*

Friedman's test showed a statistically significant reduction in SBP over time within each group (p-value < 0.001), indicating that the block effectively reduced SBP between the groups over time. However, there was no notable difference in SBP in both the groups according to the Mann-Whitney U test at any specific time point, suggesting that both treatments were similarly effective.

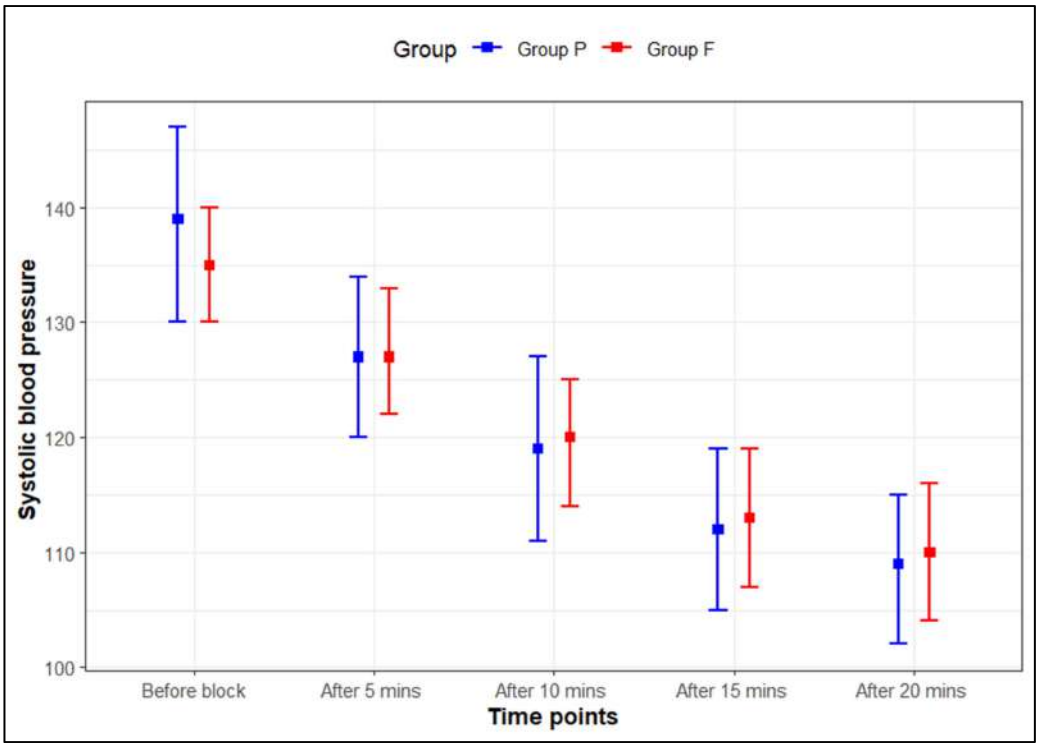

Figure 6: Mean plot of systolic blood pressure over time and groups.

The following table gives the comparison of DBP over time and groups.

Table 4: Comparison of DBP over time and groups.

DBP	Group P	Group F	Total	p-value
Before block	79.87 ± 10.34 80 (60, 100)	81.33 ± 7.76 80 (70, 90)	80.6 ± 9.1 80 (60, 100)	0.5153^{MW}
After 5 mins of block	75.47 ± 9.88 74 (54, 92)	78.33 ± 8.68 80 (60, 90)	76.9 ± 9.33 76 (54, 92)	0.2374^{t}
After 10 mins of block	70.33 ± 10.61 70 (50, 90)	72.07 ± 7.66 73 (56, 88)	71.2 ± 9.21 71 (50, 90)	0.4710^{t}
After 15 mins of block	68.07 ± 9.85 68 (54, 90)	69.27 ± 9.78 70 (52, 88)	68.67 ± 9.75 70 (52, 90)	0.6375^{t}
After 20 mins of block	65.53 ± 9.39 63 (50, 90)	67.4 ± 10.53 66 (52, 84)	66.47 ± 9.94 65 (50, 90)	0.5562^{MW}
p-value	**< 0.001^{F}***	**< 0.001^{F}***	-	-

*Abbreviation: t – Two sample t test, MW – Mann Whitney U test, F – Friedman's test, * indicates statistical significance.*

Friedman's test showed a statistically significant reduction in DBP over time within each group (p-value < 0.001), indicating that the block effectively reduced DBP in both groups over time. However, the Mann-Whitney U test showed no notable differences in DBP between the two groups at any specific time point, suggesting that both treatments were similarly effective.

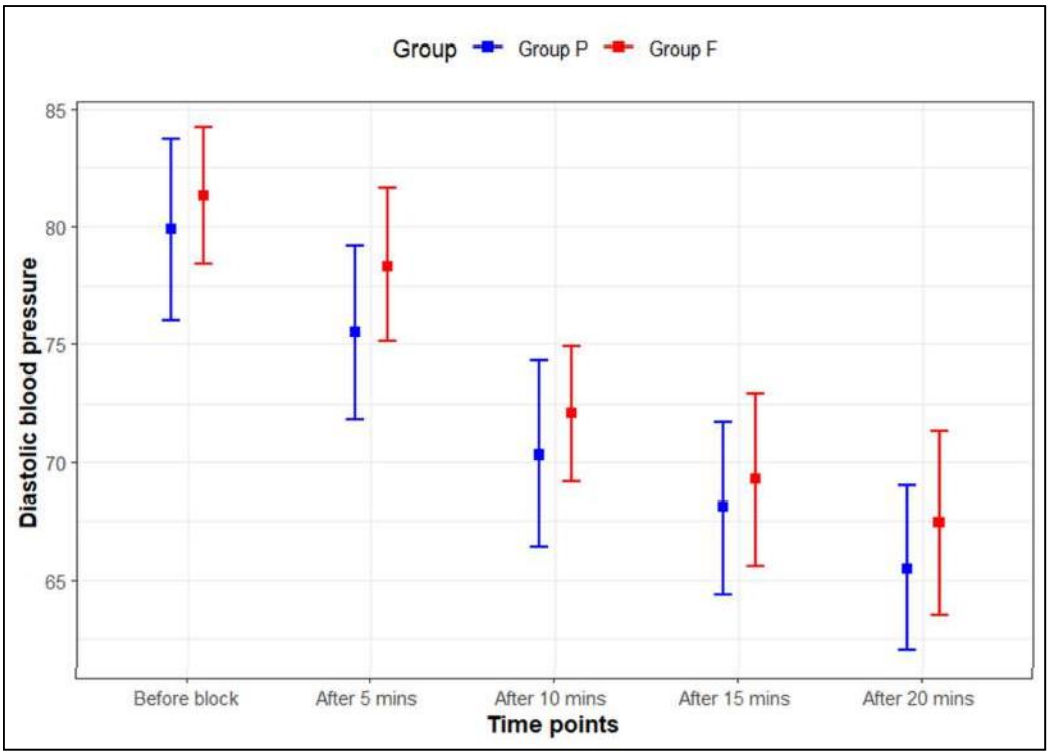

Figure 7: Mean plot of diastolic blood pressure over time and groups.

DISCUSSION

Geriatric age group are prone for fractures around hip. Pain induced by proximal femur fracture hinder the patient to give adequate positioning for spinal anaesthesia. [10] To administrate subarachnoid block smoothly in cases of hip fractures proper placement is necessary and adequate analgesia is needed. Elderly patients because of associated comorbidities will have deleterious effects with the use of systemic opioids. [5] In view of this, peripheral nerve blocks are method of choice for managing pain thus reducing consumption of opioids. [28] Based on the anatomic classification, proximal femur fractures are subdivided into fractures of the femoral head, the femoral neck, and intertrochanteric or subtrochanteric fractures. [29] The nerve supplying around the hip capsule are the FN, accessory obturator nerve, ON and LFCN [10]. Regional nerve block are an effective way to treat hip fracture pain, they have less side effects than opioids, site-specific analgesia, making them safer option. The interest of this trial is to assess the analgesic efficacy between PENG block and FICB for optimal spinal positioning.

Sample size for our study 60 patients were considered, 30 patients in each group P and F. None of the patients were excluded from our study.

In our study, the gender distribution and age were comparable.

Many patients in our study were ASA 1 and 2. But ASA distribution was comparable in both the groups.

In present study, the blocks was given by using USG by a trained anaesthesiologist and pain was assessed by VAS scale before and after performing block. Haemodynamic parameters were also recorded.

Total of 60 patients enrolled in our study, and distributed equally in both the groups. VAS scale assessed prior to block was around seven-eight in each group. Friedman's test showed a statistically significant reduction in VAS over time from fifth minute to thirth minute (group P 7-1.4 and group F 7-1.47) within each group (p-value < 0.001), indicating that the block effectively reduced pain levels in both groups over time. However, there were no notable differences in pain reduction in both the groups according to the Mann-Whitney U test at any specific interval of investigation, suggesting that both treatments were similarly effective. A similar study done by Jadon et al, with a total of 66 patients comparing analgesic efficacy of PENG and Supra-inguinal-FICB for positioning for spinal anaesthesia. The study proved PENG block better analgesia than FICB (p-value< 0.0001). But immediate pain reductionwas better in PENG than FICB at rest. Similarly in our study VAS scale after 30 minutes was reduced in both groups. Even though VAS reduction was more in PENG group but at the time of positioning statistically difference among group was insignificant. [9]

In another study, done by Mosaffa et al [3] comparing PENG block and FICB with a total of 52 patients, the VAS scale showed no notable difference in the two groupsprior to block. In both the groups 15 minutes of block (prior to spinal anaesthesia) and12 hours after surgery, the PENG block group VAS scale was lesser than that of the FICB group (p= 0.031 and 0.021).

A comparative study done by Shankar et al [30] where PENG block was compared to FICB to assess pain while giving position for spinal anaesthesia in hip surgery using 0.25% Ropivacaine in 60 patients. Group P showed (0.6 ± 0.4) significant reduction in VAS scale when compared to group F (2.6 ± 1.2) while

placing patient for spinal anaesthesia after 30 minutes of giving the block at dynamic hip movement and at rest. As a rescue analgesia IV fentanyl 0.5µg/kg given if VAS scale was ≥4.

A study was done by Senthil et al [8] on 40 patients to assess immediate pain relief, dynamic pain grades and post block pain free period. It was noted that, before block median VAS scale was similar both the groups(p-value= 0.556), but after 5 minutes till 30 minutes it was statistically highly significant(p-value<0.001), and itwas no pain to mild pain in group PENG and in group FICB mild to moderate painwas observed. Senthil et al observed that,PENG group showed significant reduction in VAS scale at 14, 18, and 24 hours than FICB group.

A study by Jeevendiran et al [31] concluded that, PENG block provides better analgesia than femoral nerve block (FNB) where VAS scale reduced from moderate-severe pain (VAS 5 - 7) to mild pain (VAS 0 - 2) for proper placement of patient in hip fracture ($p < 0.05$).

A study done by Chaudhary et al (10), included 60 patients in the study, using USG guided PENG block versus FNB to position the patient for subarachnoid block in hip fracture surgery concluded that PENG block showed significant reduction in pain score when compared to FNB.

Pre-operative PENG block, according Alrefaey et al [11] is a useful way to manage pain associated with positioning during spinal anaesthesia. It also improves the patient's sitting angle, which minimizes the amount of time needed for a spinal block and enhances the anaesthesiologist's and patient's experience.

Kukreja et al [32] conducted a second retrospective case series comparing PENG block for original hip arthroplasty against revision revealed that, in their studythe median reduction in pain levels from primary to revision was 7 points.

Based on a study done by S. Li et al [33] PENG block contributes to improved surgical outcomes and rehabilitation by continuously supplying analgesia following surgery in addition to reducing discomfort during the combined spinal-epidural anaesthetic procedure.

According to the fore mentioned research, PENG has more analgesic efficacy than FICB. Comparably, our study's VAS scores at the 30th minute mark for PENGwere 1.5 and for FICB were 1.47. Although, there was a minor variation in the VAS at the 30th minute mark, it did not prove statistically significant.

In our study Friedman's test showed a statistically significant reduction in SBP over time within each group (p-value < 0.001), indicating that the block effectively reduced SBP in both groups over time. However, there were no variations in SBP between the two groups according to the Mann-Whitney U test given at any specific time point, suggesting that both treatments were similarly effective.

Friedman's test showed a statistically significant reduction in DBP over time within each group (p-value < 0.001), indicating that the block effectively reduced DBP in both groups over time. However, there were no variations in DBP between the two groups according to the Mann-Whitney U test given at any specific time point, suggesting that both treatments were similarly effective.

Study by Zhou M et al [34] in this study, the effects of nerve block could be the cause of the fluctuations in HR and MAP that occurred at each time point but

maintained some stability in both the goups. Furthermore, the administration of 0.25% ropivacaine was found to be effective in maintaining stable hemodynamics in both the PENG block and FICB which was comparable to our study. In our study also we have used 0.75% ropivacaine which helps to maintain stability of hemodynamics.

According to a study by Jeevendiran et al [22] in both the groups it was found that it was statistically insignificant in terms of hemodynamics and block related adverse effects.

CONCLUSION

Pericapsular nerve group block and Fascia Iliaca compartment block effectively reduce pain in proximal femur fractures and ease in positioning during spinal anaesthesia without altering the patient haemodynamics. Thus we can conclude that PENG and FICB reduce pain in femur fracture and help in proper positioning of patient during subarachnoid block without any complications.

SUMMARY

- Pain is a major limiting factor for mobilization and prolong the recovery of patient post-operatively, which extends the duration of hospital stay.

- Hip and neck of femur fractures being very common, adequate analgesia is necessary for patients for physical and psychological stress and early recovery.

- A few nerve blocks have been described in the literature, PENG block and FICB are newer techniques which are helpful for regional analgesia, not many studies are available for comparison.

- 60 patients who were 18 years and above were randomized into two groups. Group P was given PENG block and group F was given FICB.

- HR, SBP, DBP and MAP were measured at various time points, statistically it was insignificant.

- VAS scale for pain at rest and in motion was recorded at various time intervals, it was insignificant in both the groups.

- The efficacy of the block showed a statistically significant reduction in VAS over time within each group, indicating that the block effectively reduced pain levels in both groups over time.

- Rescue analgesia was not required for any patients.

- In this study there was no complications or adverse effects noted during the study period.

LIMITATION

- The study highlights that there are few reviews available that compare the new PENG block with the traditional FICB. This limits the ability to contextualize the findings within the existing body of literature.
- The FICB can have inconsistent spread of local anaesthetic, leading to variable analgesic effects. It may not always cover all branches of the femoral nerve effectively.
- The assessment of the VAS score is subjective and can differ depending on the patient's understanding and communication with the anesthesiologist.
- Like in previous literature in this study quardriceps muscle strength was not assessed.

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ANNEXURE-I

KAHERs JNMC
BELAGAVI
INFORMED CONSENT FORM

"COMPARISON OF ANALGESIC EFFICACY BETWEEN PERICAPSULAR NERVE GROUP BLOCK (PENG) AND FASCIA ILIACA COMPARTMENT BLOCK (FICB) FOR POSITIONING DURING SUBARACNOID BLOCK IN PROXIMAL FEMUR FRACTURES – HOSPITAL BASED , A RANDOMIZED CONTROLLED TRIAL"

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Objective:

Assessment of pain after PENG block and FIC block at the time of positioning for spinal anaesthesia in proximal femur fracture patients.

Introduction:

Explanation of procedure:

- If you agree to enroll in my study, I will ask you present, past and family history. Then you will be clinically examined in detail. You will be allotted into one of the two groups randomly using computer generated software.

- Group P will receive PENG block with 15 ml 0.75% ropivacaine.

- Group F will receive FIC block with 15 ml 0.75% ropivacaine.

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population atlarge.
Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. Thedata collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups. However, your identity will never be revealed.

Questions:

If you have any question or complaints with regard to your right as study participant you may contact **Dr Harsha Hegde**, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study**" COMPARISON OF ANALGESIC EFFICACY BETWEEN PERICAPSULAR NERVE GROUP BLOCK (PENG) AND FASCIA ILIACA COMPARTMENT BLOCK (FICB) FOR POSITIONING DURING SUBARACNOID BLOCK IN PROXIMAL FEMUR FRACTURES – HOSPITAL BASED , A RANDOMIZED CONTROLLED TRIAL"** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE-II

PROFORMA

"COMPARISON OF ANALGESIC EFFICACY BETWEEN PERICAPSULAR NERVE GROUP BLOCK (PENG) AND FASCIA ILIACA COMPARTMENT BLOCK (FICB) FOR POSITIONING DURING SUBARACNOID BLOCK IN PROXIMAL FEMUR FRACTURES – HOSPITAL BASED , A RANDOMIZED CONTROLLED TRIAL"

GROUP ALLOTED: P F

Date of Examination : IP No. :

Name :

Age : Gender : Occupation :

Address :

PRE-ANAESTHETIC EVALUATION

Past History

Hypertension		**Arrhythmias**	
Diabetes Mellitus		**Valvular Heart Disease**	
Ischaemic Heart Disease		**Previous Surgeries**	

General physical examination

Weight		**Pallor**	
Height		**Icterus**	
Temperature (°F)		**Cyanosis**	

Pulse		**Clubbing**	
Blood Pressure			
Respiratory Rate			

Systemic examination:

Respiratory System		**CNS**	
CVS		**GIT**	

PREOPERATIVE PHYSICAL STATUS ASA Grade I II III IV V

VISUAL ANALOGUE SCALE

BEFORE GIVING BLOCK:

NONE 0	MILD PAIN 1-3	MODERATE PAIN 4-6	SEVERE PAIN 7-10

AFTER GIVING BLOCK:

DURATION	**NO PAIN** **0**	**MILD PAIN** **1-3**	**MODERATE PAIN** **4-6**	**SEVERE PAIN** **7-10**
0 MINUTES				

5 MINUTES				
10 MINUTES				
15 MINUTES				
20 MINUTES				
25 MINUTES				
30 MINUTES				

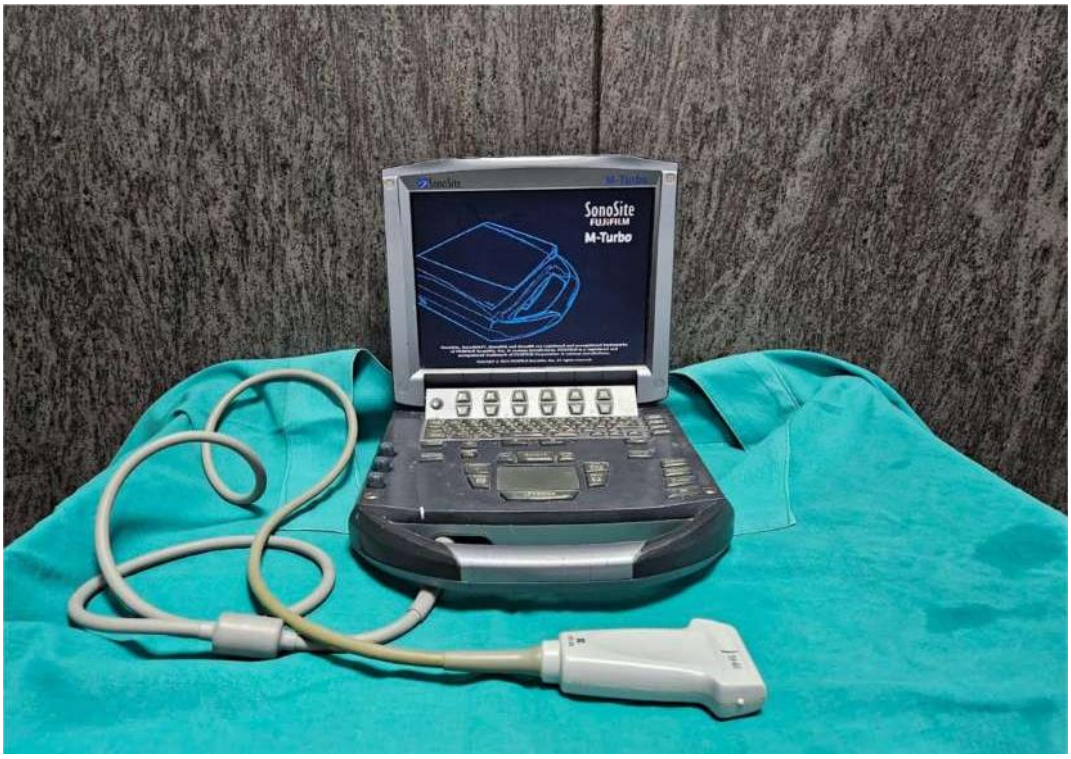
PARAMETERS	BEFORE BLOCK	AFTER BLOCK			
		5 MINS	10 MINS	15 MINS	20 MINS
Heart Rate					
Systolic blood pressure					
Diastolic blood pressure					
Mean arterial blood pressure					
Spo2					

RESCUE ANALGESIA – PARACETAMOL (15mg/kg intravenous)

MODERATE PAIN	SEVERE PAIN

INVESTIGATOR	
WITNESS	
ANAESTHESIOLOGIST	

ANNEXURE III- PHOTOGRAPHS



Photograph 1- USG machine with probe

Photograph 2- Linear ultrasound probe

Photograph 3- 0.75% Ropivacaine

Photograph 4- Spinal tray

Photograph 5 – USG image of PENG Block

Photograph 6 – USG image of FICB

ANNEXURE IV- MASTER CHART

SL.NO.	NAME	SEX	AGE	TEMP	PRE-OPERATIVE VITALS				ASA	GROUP A/B	VAS BEFORE BLOCK	VAS AFTER 5 MINS OF BLOCK	VAS AFTER 10 MINS OF BLOCK	VAS AFTER 15 MINS OF BLOCK	VAS AFTER 20 MINS OF BLOCK	VAS AFTER 25 MINS OF BLOCK	VAS AFTER 30 MINS OF BLOCK	VITALS AT 5TH MINUTE				VITALS AT 10TH MINUTE				VITALS AT 15TH MINUTE				VITALS AT 20TH MINUTE				RESCUE ANALGESIA
					PR	RR	SBP	DBP										PR	SP02	SBP	DBP	PR	SPO2	SBP	DBP	PR	SPO2	SBP	DBP	PR	SPO2	SBP	DBP	
1	Krishna Ningappa Patil	Male	85	Afebrile	80	12	130	90	1	B	7	7	7	7	4	4	1	80	100	130	90	76	100	120	84	76	100	116	80	72	100	110	80	Nil
2	Sharavva Satyappa	Female	78	Afebrile	66	12	140	90	2	B	4	4	4	4	1	1	1	66	100	136	90	60	100	124	72	60	100	110	70	56	100	110	80	Nil
3	Basirabi Maktum Sahib	Female	88	Afebrile	84	12	110	60	1	A	7	4	4	1	1	1	1	84	100	104	70	84	100	96	60	76	100	90	70	76	100	90	70	Nil
4	Shantabai Shinde	Female	72	Afebrile	60	12	150	80	2	A	7	4	4	4	1	1	3	60	100	142	74	60	100	136	68	62	100	122	80	58	100	120	70	Nil
5	Dalayat Kamalsab Hamidsab	Male	70	Afebrile	84	12	148	90	2	B	7	7	4	1	1	1	3	84	100	130	88	80	100	124	80	78	100	116	74	72	100	110	70	Nil
6	Mahadevi Vijay Halyal	Female	71	Afebrile	80	12	160	80	2	B	7	7	4	4	1	1	2	80	100	154	76	72	100	142	70	72	100	140	70	66	100	138	80	Nil
7	Mali Shanta Mahadev	Female	79	Afebrile	62	13	142	90	2	B	7	4	4	1	1	1	2	62	100	138	84	60	100	124	80	60	100	112	80	60	100	106	82	Nil
8	Basappa Siddappa Pujari	Male	63	Febrile	112	14	120	70	2	B	7	7	4	4	4	1	2	100	100	114	66	96	100	106	72	90	100	100	70	90	100	96	60	Nil
9	Mabusab Abdulsab	Male	41	Afebrile	100	12	140	90	2	B	7	4	4	4	1	1	1	98	100	132	86	90	100	126	80	88	100	118	80	82	100	114	84	Nil
10	Kallappa C Chakadi	Male	72	Afebrile	100	13	150	100	2	A	7	7	4	4	4	1	1	90	100	144	88	88	100	140	90	80	100	126	70	80	100	122	80	Nil
11	Borawwa Ulavapp	Female	66	Afebrile	104	12	160	80	2	A	7	4	4	1	1	1	1	98	100	154	74	90	100	140	80	90	100	130	80	86	100	122	70	Nil
12	Rajendra Gopal Ghatge	Male	55	Afebrile	80	14	140	90	2	B	7	4	4	4	4	4	4	80	100	132	80	78	100	120	76	78	100	110	86	74	100	104	84	Nil
13	Satthavva Doddappa	Female	62	Afebrile	126	13	150	70	2	A	7	7	4	4	4	1	1	110	100	142	70	100	100	134	60	92	100	118	76	90	100	118	76	Nil
14	Maruti Kedari Bolke	Male	72	Afebrile	80	11	110	60	2	A	7	7	4	4	1	1	1	74	100	110	54	70	100	102	50	70	100	98	54	70	100	94	50	Nil
15	Sundravva Biradar	Female	57	Afebrile	82	14	110	90	1	A	7	7	7	4	1	1	1	76	100	104	80	76	100	100	82	76	100	96	74	76	100	100	68	Nil
16	Shivaji Pawar	Male	73	Afebrile	76	12	130	70	2	A	7	7	4	1	1	1	1	70	100	124	60	68	100	118	62	68	100	106	56	64	100	100	60	Nil
17	Indravati Maruti Patil	Female	71	Afebrile	78	12	140	90	2	A	7	7	7	4	1	1	1	74	100	132	84	70	100	122	76	70	100	108	66	66	100	106	62	Nil
18	Bhumika	Female	32	Afebrile	70	12	130	80	1	B	7	7	7	4	1	1	1	70	100	120	66	66	100	112	66	60	100	104	54	60	100	100	56	Nil
19	Basavraj M Karalappanawar	Male	27	Febrile	84	14	130	80	1	B	7	7	4	1	1	1	1	76	100	118	76	76	100	110	60	70	100	100	54	70	100	96	54	Nil
20	Muktar Ahmed Mulla	Male	72	Afebrile	106	12	132	68	2	A	7	7	4	4	1	1	2	78	100	122	68	70	100	106	58	66	100	100	56	66	100	98	60	Nil
21	Gouravva H	Female	62	Afebrile	62	14	110	80	1	B	7	7	4	4	1	1	1	88	100	100	74	80	100	94	70	80	100	90	60	80	100	90	60	Nil
22	Manohar Fakira Kangralhar	Male	47	Afebrile	90	12	130	70	1	B	7	7	4	4	1	1	1	62	100	120	70	60	100	108	64	56	100	102	62	56	100	100	58	Nil
23	Manjunath	Male	66	Afebrile	56	12	118	70	2	B	7	7	4	4	1	1	4	90	100	100	60	90	100	96	56	84	100	90	52	84	100	92	52	Nil
24	Masabi Jamadar	Female	56	Afebrile	76	12	150	80	2	A	7	7	4	4	4	4	4	58	100	132	72	58	100	124	66	52	100	108	58	50	100	102	60	Nil
25	Sharada Ganappa	Female	94	Afebrile	80	12	220	100	2	A	7	7	4	4	4	1	1	72	100	170	90	68	100	166	78	62	100	148	80	62	100	138	68	Nil

26	Shivagouda Patil	Male	84	Afebrile	76	10	160	80	2	A	7	7	4	4	1	1	1	80	100	140	72	74	100	132	72	70	100	118	70	70	100	110	70	Nil
27	Housabai M Dhuvale	Female	73	Afebrile	80	12	166	80	2	A	7	7	7	4	1	1	1	68	100	152	80	60	100	140	68	62	100	126	60	62	100	118	60	Nil
28	Shantappa	Male	75	Afebrile	68	13	150	90	2	A	7	7	4	4	4	1	1	70	100	132	90	70	100	118	78	62	100	118	70	62	100	108	68	Nil
29	Ningavva	Female	70	Afebrile	60	12	130	80	2	A	7	7	4	4	4	1	1	64	100	118	60	60	100	104	60	56	100	100	62	56	100	96	58	Nil
30	Cyril Francis	Male	78	Afebrile	108	13	128	76	2	A	7	4	1	1	1	1	1	98	100	108	76	80	100	100	70	72	100	96	72	72	100	92	64	Nil
31	Sushila Sapkale	Female	73	Afebrile	70	12	130	80	2	A	7	7	4	1	1	1	1	66	100	118	74	64	100	106	72	64	100	100	66	60	100	100	60	Nil
32	Vikas Gouda	Male	58	Afebrile	80	12	130	80	1	A	7	7	4	1	1	1	1	58	100	118	74	58	100	106	72	52	100	100	66	54	100	100	60	Nil
33	Dattaray Nagshrao	Male	87	Afebrile	88	11	150	80	2	B	7	7	7	7	4	4	4	78	100	132	80	72	100	124	74	70	100	108	70	70	100	100	62	Nil
34	Subhadra	Female	79	Afebrile	80	12	128	90	2	A	7	7	4	4	4	4	4	80	100	110	82	76	100	100	78	72	100	92	78	72	100	92	66	Nil
35	Vijay Suryakant	Male	41	Afebrile	80	12	140	80	1	A	7	7	7	4	1	1	1	88	100	126	76	82	100	118	66	80	100	108	60	80	100	104	60	Nil
36	Ramachandra Murgesh	Male	80	Afebrile	88	10	120	70	1	A	7	7	4	4	4	1	1	50	100	110	78	50	100	100	64	46	100	100	58	48	100	96	54	Nil
37	Sanjay Baburao	Male	50	Afebrile	56	14	130	90	2	B	7	4	4	1	1	1	1	62	100	126	76	60	100	118	66	58	100	108	60	58	100	104	60	Nil
38	Vinayak Appasaheb	Male	61	Afebrile	70	11	140	80	2	B	7	4	4	4	1	1	1	68	100	132	80	60	100	124	74	60	100	108	70	60	100	100	62	Nil
39	Sonabai Muggi	Female	74	Afebrile	68	13	110	70	2	B	7	4	4	1	1	1	1	52	100	100	66	50	100	96	60	54	100	92	56	50	100	90	54	Nil
40	Basappa M	Male	70	Afebrile	56	12	118	70	2	A	7	4	4	4	4	4	4	60	100	100	62	60	100	94	54	56	100	92	56	54	100	92	56	Nil
41	Irappa Patil	Male	60	Afebrile	62	14	110	80	1	A	7	7	4	4	4	4	4	72	100	110	74	70	100	96	62	70	100	92	56	62	100	90	54	Nil
42	Rajashri Murgappa	Female	68	Afebrile	70	12	130	80	2	A	7	7	4	4	4	1	1	66	100	118	74	60	100	108	70	60	100	104	62	60	100	100	58	Nil
43	Mahesh Basakri	Male	73	Afebrile	68	12	130	80	1	B	7	4	4	1	1	1	1	60	100	110	82	56	100	100	78	56	100	92	78	58	100	92	66	Nil
44	Shakuntala Pujari	Female	78	Afebrile	72	16	160	90	2	B	7	7	4	4	1	1	1	64	100	140	88	60	100	132	76	60	100	108	64	60	100	102	58	Nil
45	Karthik Mandavi	Male	19	Afebrile	76	14	110	70	1	A	7	4	4	1	1	1	1	60	100	92	70	58	100	90	70	58	100	100	72	54	100	100	70	Nil
46	Shantabai Dhanavant	Female	70	Afebrile	62	11	160	90	2	A	7	4	4	1	1	1	1	54	100	154	90	54	100	156	86	50	100	156	80	50	100	150	80	Nil
47	Vidya Krishnanand	Female	67	Afebrile	62	12	140	90	1	A	7	4	4	1	1	1	1	66	100	136	90	66	100	136	88	60	100	130	84	60	100	130	84	Nil
48	Sonabai Dhanaji	Female	74	Afebrile	74	13	154	90	2	B	7	4	4	1	1	1	1	60	100	150	90	62	100	146	88	60	100	142	88	58	100	142	80	Nil
49	Shakuntala Parutayya	Female	78	Afebrile	66	11	130	80	2	B	7	4	4	1	1	1	1	62	100	130	80	58	100	130	74	60	100	124	66	60	100	124	70	Nil
50	Kallappa Gouda	Male	62	Afebrile	70	13	170	92	2	A	7	4	4	1	1	1	1	58	100	166	92	58	100	166	90	56	100	160	90	56	100	160	90	Nil
51	Sharada Devi	Female	53	Afebrile	66	12	120	70	1	B	7	4	4	1	1	1	1	54	100	120	70	50	100	114	70	50	100	116	70	50	100	116	70	Nil
52	Shakuntala	Female	72	Afebrile	62	14	140	80	2	B	7	4	4	1	1	1	1	66	100	136	80	60	100	136	74	62	100	132	70	60	100	132	72	Nil
53	Basavraj Patil	Male	57	Afebrile	70	14	130	70	1	B	7	4	4	1	1	1	1	60	100	130	70	58	100	128	66	56	100	120	66	56	100	120	66	Nil
54	Sudheer M	Male	42	Afebrile	88	13	126	70	1	A	7	4	4	1	1	1	1	62	100	122	66	60	100	118	60	60	100	110	60	60	100	110	60	Nil
55	Sunita Manohar Jigini	Female	72	Afebrile	98	11	160	90	2	B	7	7	4	1	1	1	1	60	100	160	90	58	100	154	80	58	100	154	80	56	100	150	80	Nil
56	Paravati Babu Patil	Female	84	Afebrile	78	13	120	80	1	B	7	7	7	4	1	1	1	54	100	120	80	50	100	120	74	52	100	120	70	50	100	120	70	Nil
57	Basavanni Nagappa Navalgi	Male	77	Afebrile	64	10	136	90	2	B	7	7	7	4	1	1	1	58	100	136	90	52	100	130	80	54	100	130	80	54	100	130	80	Nil
58	Laxmi Kale	Female	62	Afebrile	80	12	130	80	1	B	7	7	4	4	4	1	1	60	100	116	76	62	100	116	70	60	100	104	60	60	100	102	58	Nil
59	Shanta	Female	58	Afebrile	62	12	140	70	1	B	7	7	7	4	1	1	1	60	100	126	66	60	100	110	60	58	100	112	60	58	100	98	60	Nil
60	Ashok	Male	47	Afebrile	68	13	134	80	1	B	7	7	4	4	1	1	1	56	100	128	80	56	100	112	68	54	100	108	78	54	100	102	54	Nil

ANNEXURE V – KEY TO MASTERCHART

ASA	American Society of Anaesthesiologists (Grades I and II)
Temp	Temperature
VAS	Visual Analogue Scale
PR	Pulse Rate
SpO2	Saturation of peripheral oxygen (%)
SBP	Systolic Blood Pressure (mm Hg)
DBP	Diastolic Blood Pressure (mm Hg)