A COMPARATIVE STUDY OF CONTINUOUS POSTERIOR LUMBAR PLEXUS BLOCK AND CONTINUOUS EPIDURAL BLOCK IN TOTAL HIP REPLACEMENT SURGERY

A COMPARATIVE STUDY OF CONTINUOUS POSTERIOR LUMBAR PLEXUS BLOCK AND CONTINUOUS EPIDURAL BLOCK IN TOTAL HIP REPLACEMENT SURGERY

- A prospective randomized single blind controlled clinical trial

DISEERATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQIREMENT OF THE Dr. M G R MEDICAL UNIVERSITY , CHENNAI, FOR THE DEGREE OF **M D (Anaesthesiology – Branch-X)** MARCH 2007.

CERTIFICATE

This is to certify that the dissertation entitled **““A COMPARATIVE STUDY OF CONTINUOUS POSTERIOR LUMBAR PLEXUS BLOCK AND CONTINUOUS EPIDURAL BLOCK IN TOTAL HIP REPLACEMENT SURGERY”** is the bonafide work by **Dr. R. Ravi Raj**, in the partial fulfillment of the requirement for the M.D. Degree (Anaesthesiology –Branch-X) of the Tamil Nadu Dr. M.G.R Medical University, Chennai, to be held in March 2007.

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TABLE OF CONTENTS

INTRODUCTION

Total hip replacement (THR) is the most common joint replacement procedure that aims to relieve joint pain, increase mobility and improve the quality of life of the patients with, chronic degenerative disease of hip joint and patients with proximal femoral fracture.

Anaesthesia and post operative analgesia for THR is a challenge, as the age of the patients presenting for THR varies, and 60% of the procedures are performed on patients above 65 years of age[1]. Most of these elderly patients have significant comorbid conditions like hypertension, ischemic heart disease, renal dysfunction, diabetes mellitus and obstructive pulmonary disease, all of which can adversely affect the patient management in peri-operative period. It is therefore important to choose an effective analgesic regimen with minimal side-effects to allow timely mobility, optimal functional recovery and decrease postoperative morbidity and mortality.[2]

The major intraoperative anaesthetic concerns during THR are blood loss, cardiovascular instability and hypoxemia. Blood loss is related to intraoperative tissue trauma, especially the reaming of medullary bone, and increases if an osteotomy of greater trochanter is performed to improve surgical exposure or with revision procedures. Blood loss is variable, averaging 0.5L to 1.5L intraoperatively and 300-500ml in the postoperative period[3]. Intraoperative blood loss is significantly reduced with regional anaesthesia than general anaesthesia alone.[4] Combination of general anaesthesia with regional techniques has revealed significantly lower blood loss than regional or general anaesthesia alone.

Pain after total-hip replacement (THR), although variable and of unclear duration, is severe in half of the patients at rest and is often exacerbated by movement. Postoperative pain control can be achieved by a variety of techniques, such as intravenous Patient Control

Analgesia (PCA), epidural analgesia, and lumbar plexus block. Intravenous PCA is inefficient in controlling pain during mobilization.[5] The benefit of postoperative analgesia with epidural block is offset by adverse effects such as nausea, vomiting, pruritus, urinary retention and respiratory depression.[6]

Now-a-days, general anaesthesia with continuous lumbar epidural block is the standard anaesthetic technique. Because of the efficiency and relative safety of continuous neuraxial nerve blocks, the lower extremity received little attention during the early development of continuous nerve blockade[7]. Lumbar plexus block (LBP) is an effective but underused regional technique that was described nearly three decades ago. Since the introduction of peripheral nerve stimulators, ultrasound guided nerve localization and continuous peripheral nerve block technique, a growing interest in the field of regional anaesthesia has been established with more deep and unconventional nerve blocks being performed safely.

AIM

Is Continuous lumbar plexus blockade, superior to continuous lumbar epidural blockade in total hip replacement?

REVIEW OF LITERATURE

Total hip replacement surgery:

The first total hip replacement surgery was performed in 1960. It has attained many modifications according to the latest technology in the following years. The surgery has the following steps.

- Dislocation and removal of the femoral head.
- Reaming of the acetabulum and insertion of a prosthetic plastic or ceramic acetabular cup.
- Reaming of the femur with insertion of a femoral component (metal or ceramic femoral head, and metal stem) into the femoral shaft (with or without cement). Metals used include stainless steel, alloys of cobalt and chrome, and titanium. Bone cement (with or without antibiotics) may be used to anchor the prosthesis into the bone. Joint replacements implanted without cement are designed to fit and lock into the bone directly.

Types of total hip replacement are:

1. Traditional cemented total hip replacement.
2. Uncemented total hip replacement.
3. Revision hip replacement.
4. Articular surface replacement.
5. Computer navigated hip replacement.
6. Minimally invasive procedure.

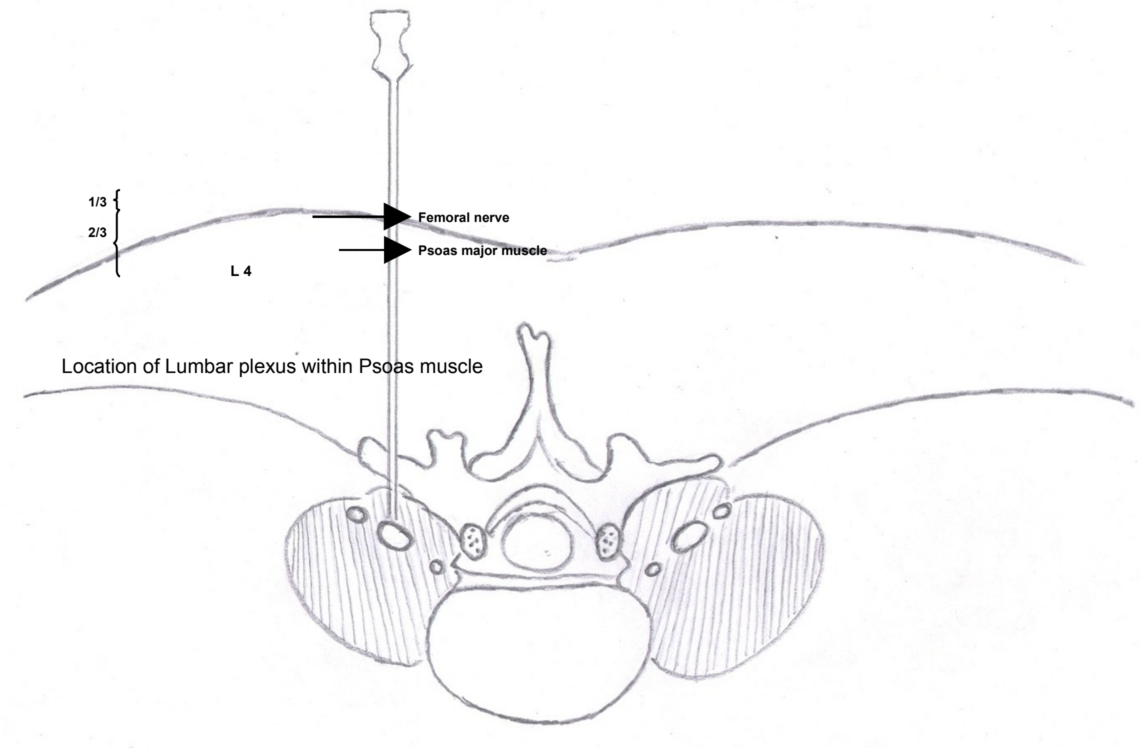
Special consideration related to the surgery:

- Bone cement implantation syndrome - Mixing polymerized methylmethacrylate (PMMA) powder with liquid MMA monomer causes exothermic reaction, which leads to cement hardening and expansion against prosthetic components. The resultant intramedullary hypertension can cause embolization of fat, bone marrow, cement, and air into the femoral venous channels.[8] The residual monomer can also cause vasodilatation and a decrease in systemic vascular resistance, thought to be the cause for the transient hypotension often seen with cement insertion. The release of tissue thromboplastin may trigger platelet aggregation, microthrombus formation in the lungs, and cardiovascular instability as a result of circulation of vasoactive substances. This can manifest clinically as hypoxia due to increased pulmonary shunt, hypotension, arrhythmias, pulmonary hypertension and decreased cardiac output. These complications are avoided by using uncemented prosthesis.
- Perioperative haemorrhage- Intra operative blood loss depends on type of surgery, duration and type of anaesthesia. The blood loss continues in to the post operative period with the mean total loss of 1510 ml and the 470ml of concealed blood.[9]
- Thromboembolism- Venous thromboembolism is a significant cause of morbidity and mortality following hip-replacement surgery. The incidence has come down by continuous regional anaesthetic techniques, intermittent leg-compression devices and low-dose anticoagulant prophylaxis.[10]

History of lumbar plexus block:

In 1973 Winnie[11] first described the anterior lumbar plexus block or 3 in 1 block. Based on paraesthesia technique in 1974 Winnie described the posterior approach of lumbar plexus block. In 1976 Chayen et al[12] modified Winnie's approach and renamed it as "psoas compartment block." Their hypothesis was that branches of the lumbar plexus and some of the sacral plexus lay close to each other at the level of L4 vertebrae, which they called the "psoas compartment," and could be reached by single injection. They used a loss-of-resistance technique to judge needle placement within the psoas compartment. In 1989 Parkinson et al[13] compared the L3 approach with that used by Winnie and Chayen at L4-L5. They modified both approaches by using a peripheral nerve stimulator.

Winnie claimed that with his approach, he could achieve blockade of both the lumbar and sacral plexuses. But Parkinson proved that none of the approaches resulted in complete sacral plexus blockade. In 1995, a human cadaver study failed to confirm the existence of a femoral nerve fascial sheath capable of conveying a liquid from below the inguinal ligament to the lumbar plexus[14]. This study also suggested that the obturator nerve would not be reliably blocked by 3 in 1 approach.



Location of Lumbar plexus within Psoas muscle

The first continuous nerve block was described in 1946 by Paul Ansbro who performed repeated supraclavicular injection of brachial plexus to prolong the duration of anaesthesia[15]. More than 30 yrs latter Selander et al published a study on axillary catheter. Because of extensive use of continuous neuraxial techniques for lower extremity anaesthesia and analgesia, it was not until 1978 that Brands and Callanan reported on the first lumbar plexus placement of an epidural catheter.[16]

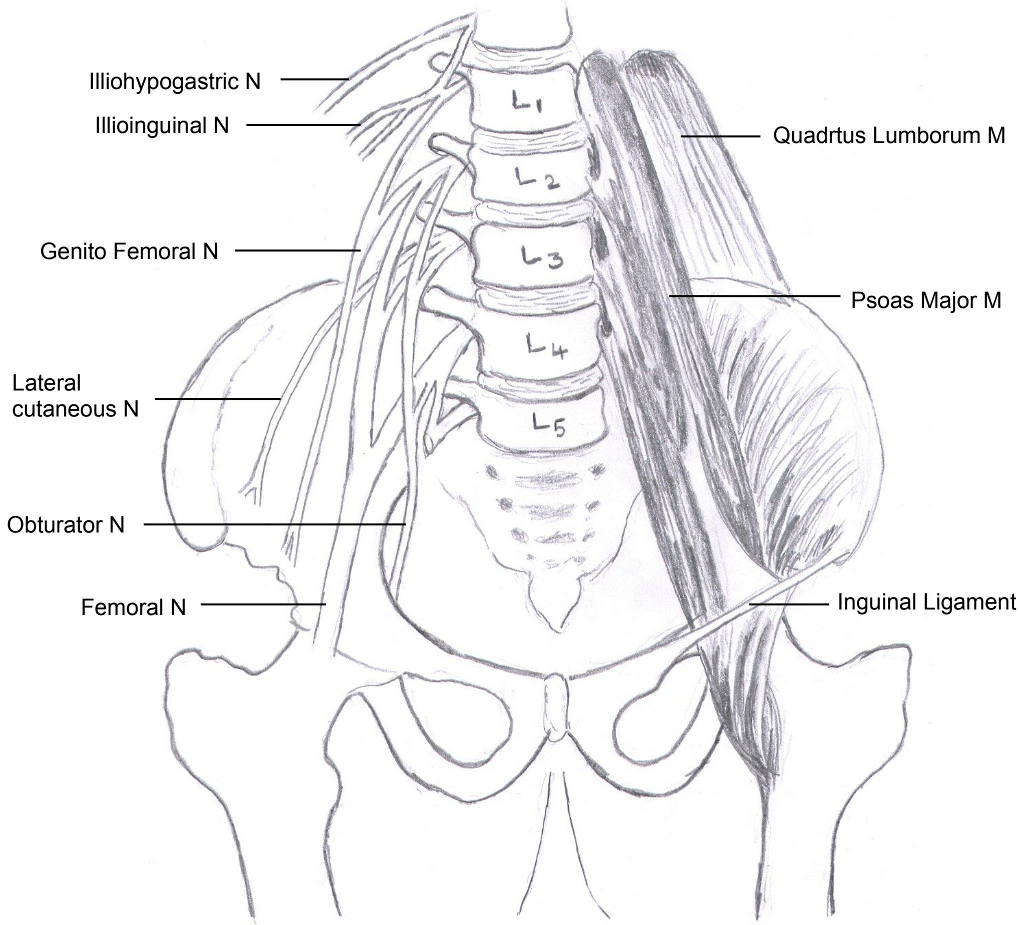
Anatomy:

Location

The exact location of the lumbar plexus remains controversial. Winnie[11] and Wedel[17] locate the lumbar plexus between the psoas and quadratus lumborum muscles. Recent anatomical studies on the plexus place by cadavaric dissection and computed tomography locate the nerve branches within the psoas muscle between its anterior two third and posterior one third.[18, 19] At the level of L5-S1 the nerve roots of L3, L4, L5 and even L2 run downwards like a compact bundle before it branches.

Origin and branch:

The lumbar plexus arises from the first four lumbar ventral rami that join within the substance of the psoas major. The first lumbar nerve, frequently supplemented by a twig from the last thoracic, splits into an upper and lower branch; the upper and larger branch divides into the iliohypogastric and



Lumbar Plexus Anatomy

ilioinguinal nerves; the lower and smaller branch unites with a branch of the second lumbar to form the genitofemoral nerve. The remainder of the second nerve, and the third and fourth nerves, divide into ventral and dorsal divisions. The ventral division of the second unites with the ventral divisions of the third and fourth nerves to form the obturator nerve. The dorsal divisions of the second and third nerves divide into two branches, a smaller branch from each uniting to form the lateral femoral cutaneous nerve, and a larger branch from each joining with the dorsal division of the fourth nerve to form the femoral nerve. The accessory obturator, when it exists, is formed by the union of two small branches given off from the third and fourth nerves.[20]

The ***femoral nerve*** is the largest terminal branch of the lumbar plexus. It descends through the psoas major muscle and emerges from the postero-lateral border at the junction of the upper two third and lower third of the muscle sandwiched between the psoas muscle and iliacus muscle deep to the iliacus fascia and medial to the lateral cutaneous nerve.It supplies branches to the iliacus muscle and innervates the pectineus muscle. It enters the thigh after passing underneath the inguinal ligament and posterior to the femoral artery where it divides into anterior and posterior divisions.It provides sensory innervation of the anterior aspect of the thigh and the medial lower leg and motor innervation of the quadriceps muscle.

The ***obturator nerve*** descends through the fibers of the psoas muscle and emerges from its medial border at the level of L5- S1. It then passes through the obturator foramen to enter the thigh. It divides into anterior and

Anatomy of lumbar plexus in relation to other structures

Cadaver dissection

posterior branches. It supplies the obturator externus and the adductor muscles of the thigh and sends sensory fibers to the hip and knee joints. Sensory innervation of the skin is quite variable. Isolated block of the obturator nerve resulted in no cutaneous distribution in 57%, an area of hypoesthesia in the superior part of popliteal fossa in 23%, and sensory deficit in the inferomedial aspect of the thigh in 20% of patients. However, all patients have adductor muscle weakness making it a more reliable sign to evaluate obturator nerve block.

The ***lateral cutaneous nerve*** of the thigh (lateral femoral cutaneous nerve) arises from L2 to L3 in the lateral part of the psoas muscle and crosses its lateral border at the level of L4. It crosses the iliacus obliquely, running toward the anterior superior iliac spines. It then passes under the inguinal ligament approximately 1 cm medial to the anterior superior iliac spines. It provides sensory innervation of the skin over the anterior and lateral aspects of the thigh as far inferiorly as the knee.

The ***iliohypogastric nerve*** perforates the transverse abdominis muscle just above the iliac crest and divides into anterior and lateral cutaneous branches. The anterior cutaneous branch innervates the skin over the anterior aspect of the abdomen above the pubis. The lateral cutaneous branch supplies the skin over the posterolateral aspect of the gluteal region.

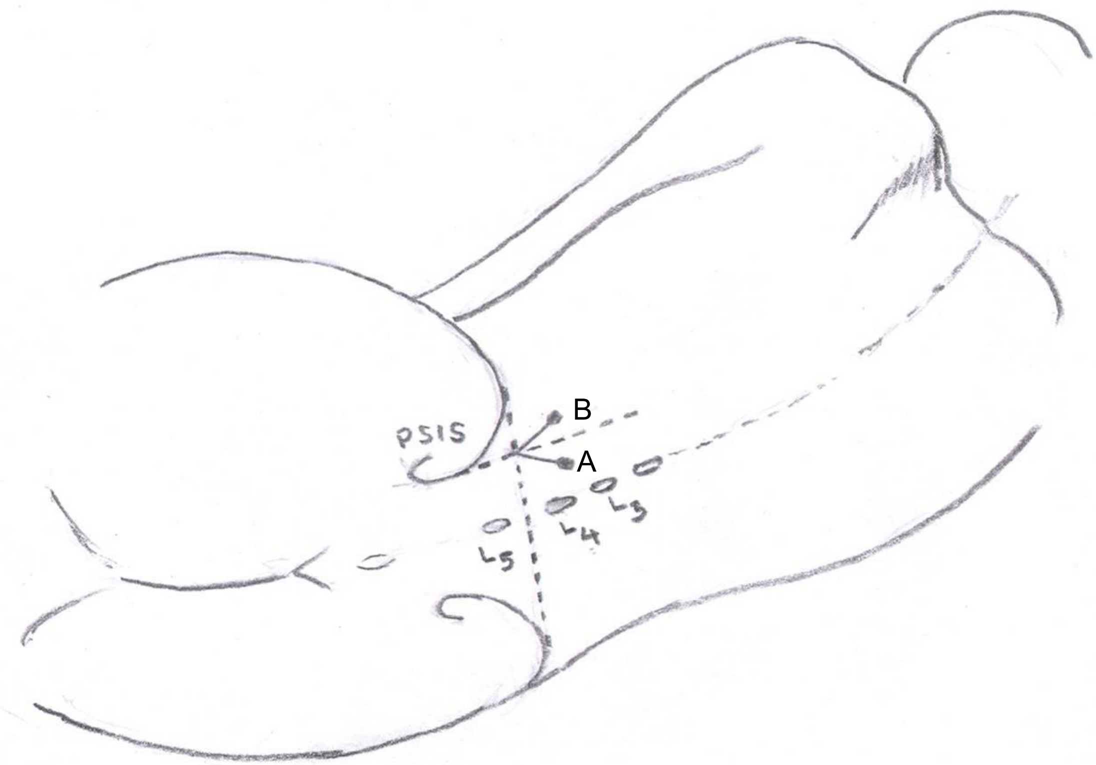
The ***ilioinguinal nerve*** also emerges at the lateral border of the psoas major muscle just caudal to the iliohypogastric nerve. It supplies the skin over the superomedial aspect of the thigh and the genital region.

The ***genitofemoral nerve*** divides into the genital and femoral branches superior to the inguinal ligament. The genital branch supplies the cremaster and skin of the scrotum in men, and in women it accompanies the round ligament of the uterus and ends by supplying the skin of the mons pubis and labium majus.The femoral branch enters the femoral sheath lateral to the femoral artery. It supplies the skin over the upper part of the femoral triangle.[21, 22]

The branches commonly blocked by posterior lumbar plexus block are femoral nerve 100%, obturator 93%, and lateral femoral cutaneous 91%.[22]

Depth of the lumbar plexus

Traversing from posterior to anterior at the level of L4-L5, the following structures would be encountered: posterior lumbar fascia, paraspinous muscles, anterior lumbar fascia, quadratus lumborum, and the psoas muscle. The estimated distance from the skin to the lumbar plexus is 8.35 cm in men (range 6.1–10.1 cm) and 7.1 cm in women (range 5.7– 9.3 cm). The depth of the lumbar plexus correlated with gender and body mass index. Importantly, the distance from the transverse process to the lumbar plexus was extremely consistent at a distance of less than 2 cm and it is independent of body mass index or gender.[23] Thus, contact with the transverse process provides a consistent landmark to avoid excessive needle penetration during psoas compartment block. The distance between the internal border of the psoas muscle and the median sagittal plane is 2.73 ± 0.63 cm. Therefore, any attempt to reach the plexus by a more



A – Winnie's approach
B – Modified Winnie's approach

medial approach or a medially directed needle may result in bilateral epidural/spinal anaesthesia.

Technique:

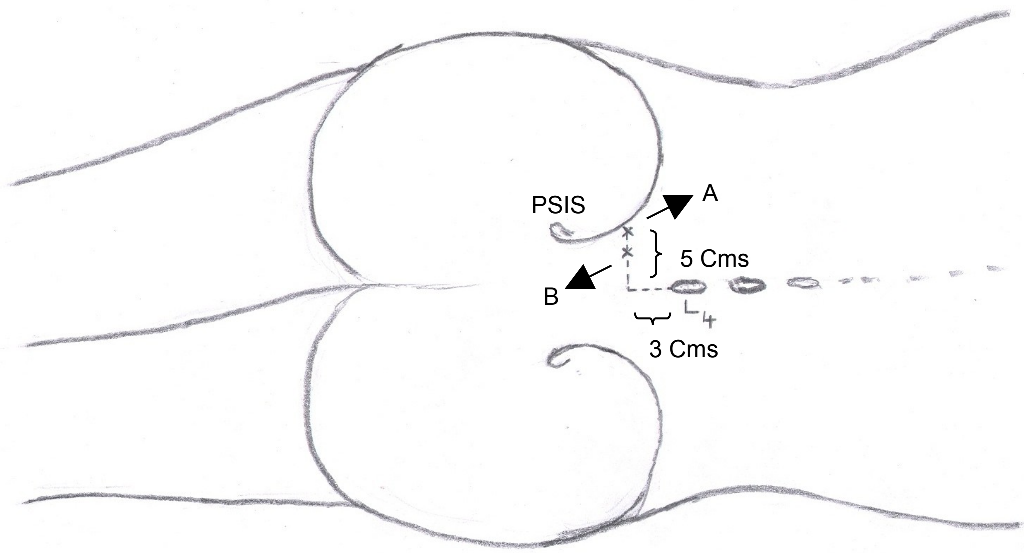
Surface landmarks

The surface landmarks of the posterior approach to lumbar plexus block are the spinous process of L4 and the posterior superior iliac spine. Identification of L4 spine and its transverse process are the most important anatomical considerations. The line connecting the highest points of iliac crests (intercristal line) usually crosses the L4 spinous process or L4/5 interspace. The transverse process of L5 is the shortest and L3 is the longest one.

Approach:

A number of posterior approaches to the lumbar plexus have been described including:

1. **Winnie** et al [11](L4-L5 approach): a needle is inserted perpendicular to skin surface at the intersection of the intercristal line with the line drawn parallel to the spine through the PSIS (posterior superior iliac spine). This places the needle tip between the transverse processes of L4 and L5. If contact with the transverse process (TP) of L5 is encountered, the needle is slightly withdrawn and redirected caudally. As the transverse process of L5 is the shortest of lumbar vertebrae, contact with the transverse process of L5 may not occur.



A – Chayen's approach
B – Pandin's approach

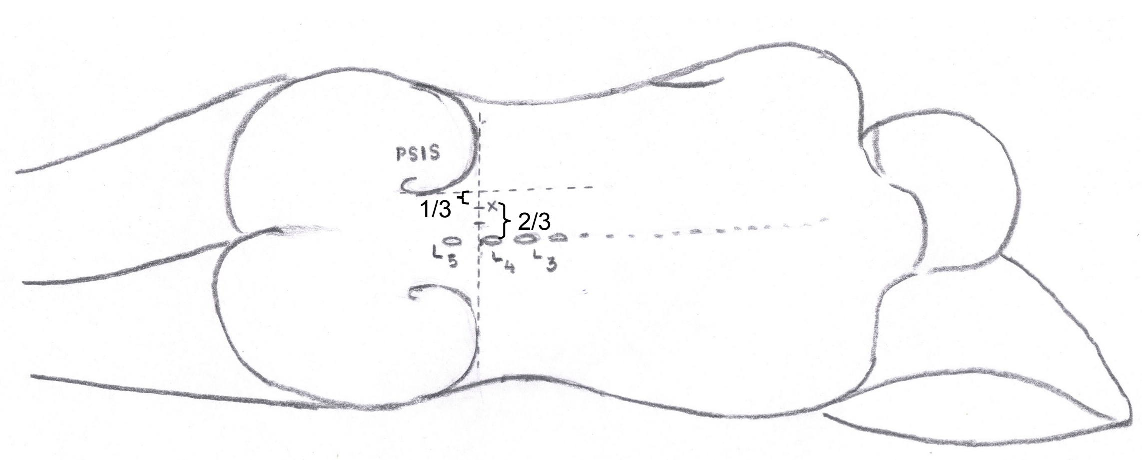
2. **Chayen** et al [12] approach: After identifying the spinous process of L4 as above, a line is drawn 3 cm caudal and 5 cm lateral. This entry point equates to the tip of L5 transverse process. The needle is inserted perpendicular to the skin until it encounters the transverse process of L5, where the course of the needle is changed to a slightly cephalic inclination.

3**. Modified Winnie's** approach. To avoid the more lateral approach by Winnie the needle is inserted with slight medial inclination of 15 degree at the intersection of the intercristal line with the line drawn parallel to the spine through the PSIS. This places the needle tip between the transverse processes of L4 and L5. If contact with the transverse process of L5 is encountered, the needle is slightly withdrawn and redirected caudally.

4. **Parkinson** et al[13] L3 approach: This technique, involves placing the tip of the needle in the psoas muscle at the level of L3. The entry point is 3 to 4 cm lateral to the SP of L3, and the needle is directed slightly cephalad to contact the transverse process of L3. After contacting

the transverse process, the needle is redirected caudad and advanced 1.5 cm deeper to reach the lumbar plexus. Usually the lower poles of the kidneys reach the level of L3, and during deep inspiration they may descend to reach the level of L3-L4. Aida et al. reported 2 cases of renal subcapsular hematoma caused by lumbar plexus blockade at L3.

5. **Pandin** et al [23] modified psoas compartment approach. The puncture site was located 3cm below the intercrest line and 3 cm lateral to the interspinous line 1 to 2 cm medial to original Chayen et al[12] approach. This modification was done to increase the obturator nerve block (92%) and to optimize catheter insertion.



Capdevila's Approach

6. **Capdevila` s** [24] approach. The needle was inserted at the junction of the lateral third and medial two thirds of a line between the spinous process of L4 and a line parallel to the spinal column passing through the posterior superior iliac spine. By CT he has confirmed the distance from the transverse process to the lumbar plexus was consistent at a distance of less than 2 cm. The importance of locating the transverse process was well documented in his study.

Locating the lumbar plexus:

Identifying the transverse process of L4 at a depth of approximately 5 to 6 cm provides a safeguard to the technique [24] and the lumbar plexus should be no more than 2 cm from this bony landmark.

Parasthaesia technique:

Winnie[11] used parasthaesia to locate the plexus, but this technique is not recommended now due to postoperative neurological sequelae.

Loss of resistance technique:

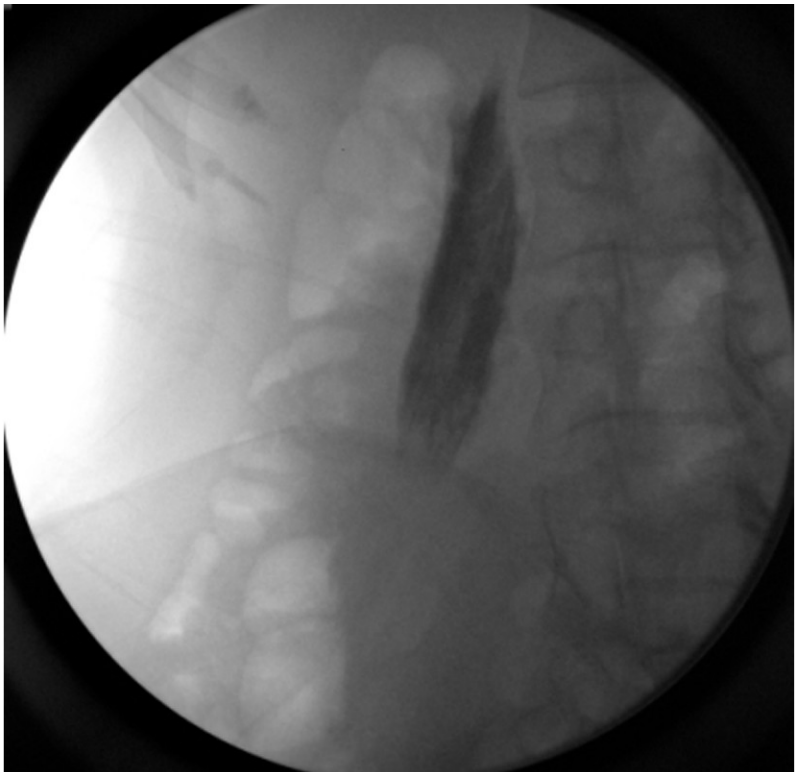
Chayen et al [12] used a loss-of-resistance technique with a 22g spinal needle and 20-mL syringe containing air to locate the psoas compartment. This is similar to other paravertebral blocks. Himat et al [25] used 17g epidural needle with 5ml glass syringe containing saline to elicit loss of resistance. As the needle advances through muscle, light tapping on the plunger elicits resistance. When the needle tip enters the psoas compartment, loss of resistance was elicited.

Electro stimulation technique:

A major advantage of using a peripheral nerve stimulator is having an objective endpoint. The motor response of the quadriceps muscle is required as an endpoint for a successful block of the lumbar plexus. Stimulation of the lumbar roots could result in contraction of the adductor muscles or the quadriceps muscles (patellar dance). Sciatic nerve stimulation occurs when the needle is too caudal and results from stimulation of L4 or L5 roots. By the use of nerve stimulators the success rate of plexus blocks increased significantly.

Ultrasound technique:

Unlike other plexus block ultrasound is not much useful in lumbar plexus block, because of the depth of LP. Kirchmair et al[26] showed ultrasound is a useful tool in increasing the efficacy of block by visualizing the solution spread and avoid complications such as renal injury.



Spread of the dye indise psoas muscle

Use of radiography:

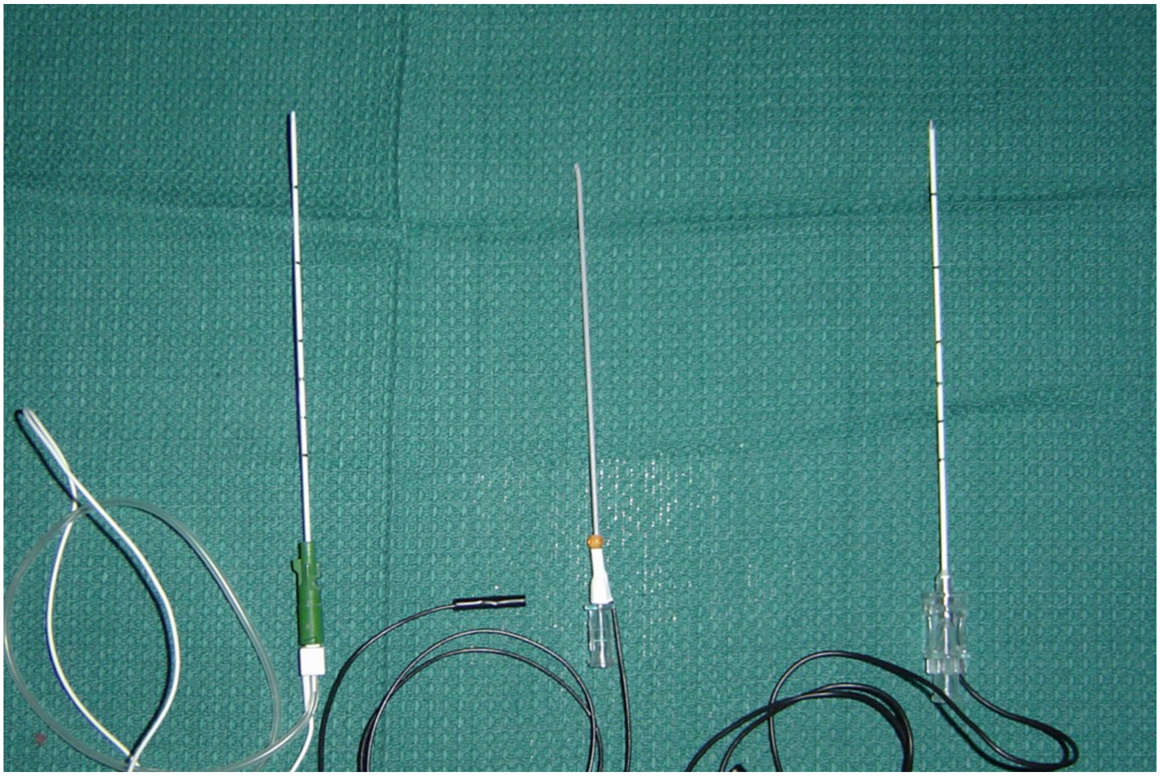
Though use of radiography to see the spread of solution and catheter tip placement is not needed as a routine[27], it is a valuable tool in situations like difficulty in locating the bony landmark and misplacement of catheter.

Physical spread of solution in LPB:

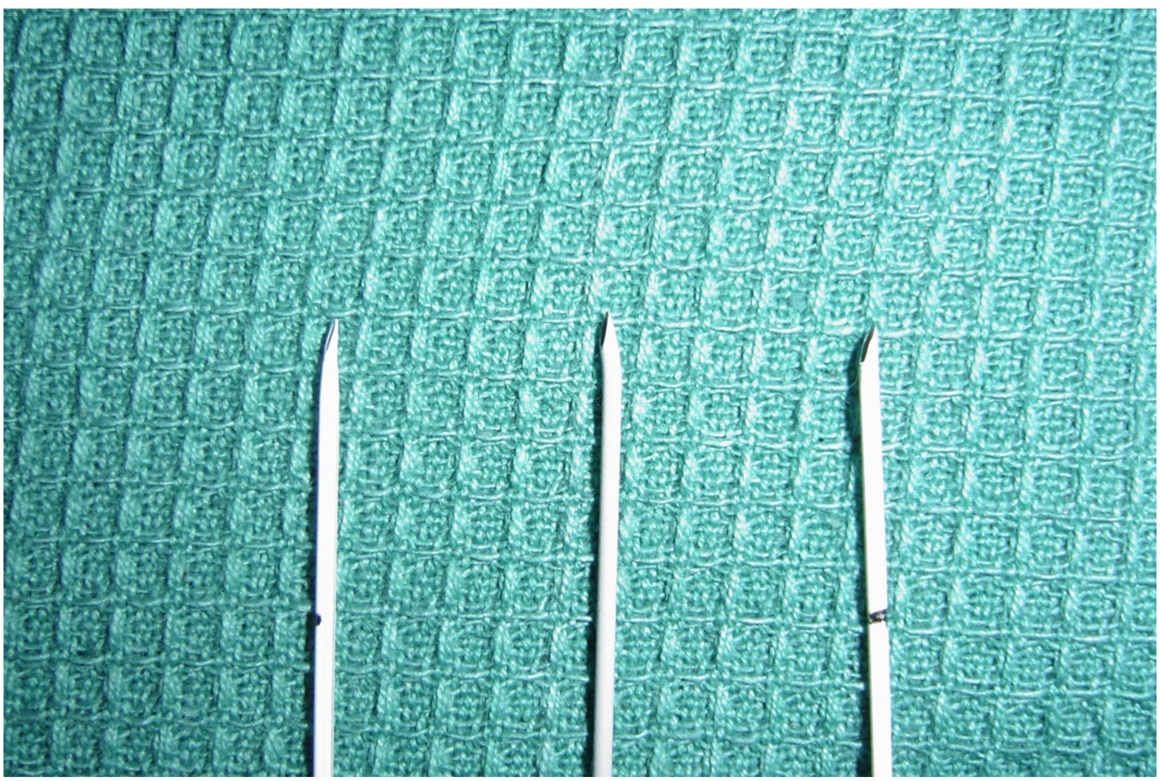
The initial controversies regarding the spread of drug in lumbar plexus block are cleared with the recent advancement in radiological imaging like contrast MRI and CT. According to the recent study by Stephen mannion[28], the most common pattern of injectate spread seen on MRI with modified Winnie and capdevilas[16] approaches to lumbar plexus block was a spread in the fascial plane within the body of the psoas muscle around lumbar branches (L2-3 and L4). The radiography with contrast shows a bundle shape spread which extends from L2 to L3.[19]

Continuous catheter technique:

The use of perineural catheter can extend the analgesic effect of block to 48-72hrs. This has significantly reduced the opioid consumption, earlier ambulation and improved patient satisfaction. The advantage of posterior lumbar plexus block over other continuous approaches to the lumbar plexus is the decreased likelihood of catheter dislodgement because of the large muscle mass that must be traversed to reach the lumbar plexus.[22] Placement of lumbar plexus catheters can be performed using a stimulating needle. Once proper placement of the needle tip is confirmed by contraction of the quadriceps muscle, the depth



Types of continuous plexus needles



Types of needle tip

of the skin to lumbar plexus is noted. Injection of 5 to 10 ml of a nonconducting solution such as dextrose 5% solution (D5W) through the introducer will help expand the psoas compartment and maintain conductivity and hence preserve current density. The catheter is then advanced 3 to 5 cm beyond the needle tip, maintaining at the same time stimulation of quadriceps muscle.

Stimulating needles for continuous plexus block:

The block needle for continuous plexus block is available in two types. The first type has a stimulating needle with a sheath, after stimulating the particular plexus the needle is removed and the catheter is threaded through the sheath. In the second type, the catheter is threaded directly through the stimulating needle.

The needle tip is either short or long beveled, Sprotte tip and Tuohy tip. The theoretical advantage of tuohy tip needle is ease in threading the catheter in a particular direction. The sets with the "catheter through the needle" particularly with the stimulating Tuohy needle is recommend by some authors.[29]

Lumbar plexus block is not used as a sole anaesthetic technique which is often supplemented with a neuraxial or general anesthetic intraoperatively, and the need for sustained postoperative analgesia is achieved with long-acting amides administered either as single injections or continuous infusions. The use of adjuvants such as clonidine, opioids, and ketorolac is common during lower-extremity peripheral techniques, their efficacy in improving the quality or duration of blockade has not been consistently shown. 0.75% ropivacaine and 0.5% bupivacaine are equally effective for lumbar plexus block. About continuous lumbar plexus block adequate data’s regarding the concentration of drugs are not available. Anker et al [30] study on femoral 3 in 1 continuous block shows that the quality of the analgesia of0.125% bupivacaine infusion is similar to 0.25% bupivacaine infusion with less motor blockade. The addition of epinephrine 5 µg/ml (1:200,000 dilution) significantly increases the duration of lidocaine from 186 minutes to 264 minutes. Odoom et al [31] study shows that significant reduction in plasma bupivacaine concentrations following lumbar plexus block with addition of epinephrine. The decision to add epinephrine (and the dose of epinephrine) is based on the concerns related to cardiac or neural ischemia versus the ability to discern an intravascular injection.

The recommended dose for lumbar plexus block is 30-40ml or 0.4ml/kg of local anaesthetic. The incidence of epidural spread is directly proportional to the volume of the bolus drug. The bolus drug should be given in small increments after a test dose. For continuous infusions 8-10ml/h rate is recommended.

Complications: Proximal spread (neuraxial block)

Epidural spread is the most common complication. The incidence of epidural spread varies greatly in the literature from less than 1% to 16%.[13, 23, 32] The epidural spread is due to the local anaesthetic traveling proximally into paravertebral space rather than the needle being placed directly in to the epidural space. The more medial approach has the highest (Chayens approach[12]) incidence of epidural spread. Epidural spread of the local anaesthetic is not a severe complication, but an expected event with minor side effects. If this occurs, the catheter should not be removed, but left in place to be used as an epidural catheter.

1. *Total spinal anaesthesia* is a feared complication of posterior lumbar plexus block. Two case reports of total spinal anaesthesia are available in the literature.[33, 34] The probable mechanism for intrathecal spread is due to the placement of the needle in the dural sleeve of a nerve root. Spinal nerve roots are surrounded by dural sleeves that follow the nerve root some centimeters outside the intervertebral foramina before becoming continuous with epineurium. This complication can be avoided by a test dose.

Hemorrhagic complications:

1. *Psoas haematoma* is a compartment syndrome that can occur due to puncture of blood vessels with in the space. One case report of lumbar plexopathy with neurological deficit is reported with a failed lumbar plexus block and received LMWH within 4.5h after the block[35]
2. *Retroperitoneal haematoma* is a dangerous complication because the symptoms appear late on 3rd – 4th post operative day. It usually present with low hemoglobin level with or without neurological deficit and ecchymosis in the back. Most of the cases associated with post operative anticoagulation and multiple attempts.[36] The combination of its deep location and inability to apply pressure after an inadvertent puncture of deeply situated blood vessels supplying the local muscles and other structures may make this block less suitable in the setting of anticoagulation as compared with other more superficial lower extremity nerve blocks.
3. *Renal subcapsular hematoma*. The lower pole of kidney especially on right side is at the level of L3. Needle directed above L3 transverse process can hit the renal parenchyma and produce subcapsular hematoma.In patients with nephroptosis and thin muscles, renal injury during the block is considered to occur more easily. In the reported two cases, the symptoms were microscopic hematuria and low back pain.[37]

The American society of Regional Anesthesiologists recommended in a consensus statement that continuous perineural block catheters be regarded as similar to neuraxial catheters in the presence of anticoagulation therapy[38]

Local anaesthetic systemic toxicity:

Intravascular injection can rapidly lead to seizure, cardiac arrest, and, eventually, death.

An adequately performed test dose helped to detect 7 out of 13 intravascular injections in one study. The best way to prevent toxicity is still a negative test dose and slow fractionated injection. The persistence of a myotonic response with neurostimulation after the injection of 1 ml of normal saline or local anaesthetic can be due to intravascular injection. Deep sedation can mask initial symptoms of systemic local anaesthetics absorption. Cardiac arrests with intravascular injection of bupivacaine and ropivacaine are reported during lumbar plexus block.[39, 40]

Neurologic complications:

Neurotoxicity of a local anesthetic is caused by its neurotoxic potency, its concentration, and the duration of its contact with the nerve. A case report of femoral nerve injury due to the direct needle trauma to the nerve root that recovered fully after 6 months.[41] Factors influencing transient or permanent nerve injury after peripheral nerve blocks include direct needle or catheter trauma and local ischemia from internal compression (intraneural injection of local anesthetic) or extraneural compression (volume of local anesthetic or hematoma).[42]

Misplacement of catheter:

Catheter tips have been located in the epidural space, abdominal cavity, retroperitoneal cavity, subarachnoid space, L_4-L_5 intervertebral disc and in paravertebral space.[24, 27,33,43,44] The optimal distance of catheter advancement is controversial. De Biasi et al[27] reported advancement of 2 cm, Pandin et al[23]. 3 cm, and Capdevila et al[16] 5 cm to 8 cm. The chance of misplacement is high with the catheter length more than 5cm inside space. Test dose after catheter placement instead of after needle placement will avoid complications. In case of doubtful placement radiography with contrast should be done to find the catheter tip location. Stimulating catheters are the new option to avoid catheter misplacement, but the real advantage of stimulating over nonstimulating catheters is still in debate.[45]

Infection:

So far only few studies have come on continuous perineural catheter infection. The incidence is highest up to 57% with femoral catheters. Bacterial species found include staphylococcus epidermidis, gram negative bacilli, and staphylococcus aureus[7]. Risk factors for local inflammation are patients in ICU, males, catheter duration longer than 48 h, absence of prophylactic antibiotics, diabetes, and femoral nerve blockade. Catheter should be removed and appropriate antibiotics should be prescribed when signs of infection are present.

Contraindications:

Similar to the neuraxial techniques of regional anaesthesia lumbar plexus block is contraindicated in the following situations

1. Patient refusal
2. Infection in the area of needle puncture
3. Anatomical abnormality of the spine
4. Coagulation abnormalities
5. Neurological deficit in the lower limbs
6. Renal enlargement like hydronephrosis
7. Morbidly obese BMI>30 kg / m^2

Epidural block:

History:

Epidural anaesthesia is a central neuraxial block technique with many applications. The epidural space was first described by Corning in 1901, and Fidel Pages first used epidural anaesthesia in humans in 1921. In 1945 Tuohy introduced the needle which is still most commonly used for epidural anaesthesia.

Anatomy:

The epidural space surrounds the dural sac and is bounded by the posterior longitudinal ligament anteriorly, the ligamenta flava and the periosteum of the laminae posteriorly, and the pedicles of the spinal column and the intervertebral foramina containing their neural elements laterally. The space communicates freely with the paravertebral space through the intervertebral foramina. Superiorly, the space is anatomically closed at the foramen magnum where the spinal dura attaches with the endosteal dura of the cranium. The epidural space contains loose areolar connective tissue, semiliquid fat, lymphatics, arteries, an extensive plexus of veins, and the spinal nerve roots as they exit the dural sac and pass through the intervertebral foramina.

Techniques and approach to identify the epidural space:

Loss of resistance technique with saline or air is commonly used to identify the space. The epidural space is located by a midline or paramedian approach.

Mechanism of epidural blockade:

Local anaesthetic acts on the nerve roots in the epidural space and produces reversible blockade by preventing the passage of sodium ions through nerve membrane. Another mechanism for neural blockade assumes that local anaesthetic passes through the dura and arachnoid maters to reach the spinal cord itself.

Factors Affecting Epidural Anaesthesia:

The major factors affecting the epidural anaesthesia are the site of injection, dosage of local anaesthetic, age and the minor factors are height, weight and posture.

Physiological Effects of Epidural Blockade:

Vasodilatation of resistance and capacitance vessels occurs, causing relative hypovolaemia and tachycardia, with a resultant drop in blood pressure. This is exacerbated by blockade of the sympathetic nerve supply to the adrenal glands, preventing the release of catecholamines.

Complications and Side Effects:

Hypotension, urinary retention, pruritus, pressure sore and transient neurological injuries are the minor complications and the major complications are total spinal, epidural haematoma, epidural abscess severe respiratory depression and arachnoiditis.

Contraindications:

Absolute contraindications

- Patient refusal
- Coagulopathy. Clotting abnormalities may lead to the development of a large haematoma leading to spinal cord compression.
- Therapeutic anticoagulation.
- Skin infection at injection site. Leads to serious complications such as meningitis or epidural abscess.
- Raised intracranial pressure. Accidental dural puncture in a patient with raised ICP may lead to brainstem herniation (coning).

- Hypovolaemia. The sympathetic blockade produced by epidurals, in combination with uncorrected hypovolaemia, may cause profound circulatory collapse.

Relative contraindications

- Pre-existing neurological disorders, such as multiple sclerosis, may be a contraindication.
- Fixed cardiac output states. Probably relative rather than absolute. This includes aortic stenosis, hypertrophic obstructive cardiomyopathy (HOCM), mitral stenosis and complete heart block. Patients with these cardiovascular abnormalities are unable to increase their cardiac output in response to the peripheral vasodilatation caused by epidural blockade.
- Anatomical abnormalities of vertebral column may make the placement of an epidural technically impossible.
- Prophylactic low dose heparin

Epidural for total hip replacement:

The incidence of deep venous thrombosis and of pulmonary embolism after total hip replacement surgery was lower in patients given continuous lumbar epidural anaesthesia than in others with general anaesthesia alone. The thromboprophylactic effect of continuous lumbar epidural anaesthesia is explained by its beneficial influence on all factors of the triad proposed by Virchow, viz. blood flow, factors within the blood itself and increases the blood flow. Other characteristics include an inhibitory action on platelet aggregation and stabilizing effect on leukocytes and endothelial cells--effects exerted by the local anaesthetics. It also reduce the intraoperative and post operative blood loss and earlier mobilization.[46, 47, 48]

Though there are many studies [49, 50] on single shot posterior lumbar plexus blockade only few randomized control clinical trials[51-57] were available on comparison of continuous lumbar plexus block.

Jacques et al [51] compared continuous lumbar plexus with PCA morphine for postoperative pain management after open reduction and internal fixation of acetabular in 26 patients. The lumbar plexus group demonstrated a lower requirement of opioid and earlier effective unassisted ambulation.

Nava et al [52] compared continuous lumbar plexus block with continuous lumbar epidural block in combination with spinal anaesthesia for total knee arthroplasty. Patient controlled infusion of local anaesthetic was used for both groups. Mean visual analog pain score was always lower than 3 at rest and lower than 5 during movements in lumbar plexus group. No differences between groups were noted in complications like vomiting, pruritus, motor block and catheter related problems.

Capdevila et al [24] performed continuous lumbar plexus block in total 80 cases and computed tomographic measurements in 35 patients. By injecting 10ml of contrast through the lumbar plexus catheter they have located the catheter within the psoas major muscle in 74%, it was located in the area between the psoas and quadratus lumborum muscles in 22% and three catheters were in improper location. At 1h, sensory blockade of femoral nerve, obturator nerve and lateral cutaneous nerve was successful in 95%, 90%, and 85% respectively. At 24h, these same rates were 88%, 88% and 83% respectively. The branches of lumbar plexus could not be localized on the line passing through the posterior superior iliac spine. The depth of lumbar plexus was more in men and this was positively correlated with the weight of the patient.

Turker et al [53] compared continuous lumbar plexus and continuous lumbar epidural for partial hip replacement surgery in 30 patients. The epidural group required significantly more attempts and longer duration than the psoas block. Epidural Group also showed significantly greater drops in mean arterial pressure and needed more vasopressor. The groups were similar regarding pain scores and patient satisfaction, but epidural group had higher incidence of motor blockade and significantly more complications.

Singelyn et al [54] compared the effects of intravenous patient controlled analgesia (PCA), continuous epidural analgesia and continuous femoral sheath block for total hip arthroplasty in total 45 patients. The quality of pain relief, postoperative rehabilitation, and duration of hospital stay were comparable in all the groups. When compared with the two other techniques, continuous femoral nerve block was associated with a lower incidence of side effects.

Brain et al [55] recently conducted a prospective feasibility study to make total hip. arthroplasty as an overnight procedure using an ambulatory continuous psoas compartment nerve block. . Patients were discharged home when they met specific, prospectively defined criteria, as early as post operative day 3 for the first phase and post operative day 1 for the second phase. Of the patients in the first phase (n = 7) who remained hospitalized for at least 3 postoperative nights, 5 met discharge criteria on post operative day 1 and the remainder on post operative day 2. Of the patients in phase 2 (n = 5), all but 1 met discharge criteria on post operative day 1 and 3 were discharged directly home on post operative day 1. Postoperative pain was well controlled, opioid requirements and sleep disturbances were minimal and patient satisfaction high.

MATERIAL AND METHODS

The aim of the study was to assess if continuous lumbar plexus blockade was superior to continuous lumbar epidural blockade in total hip replacement surgery and compare the hemodynamic stability, pain relief and incidence of complications between the two groups.

After obtaining institutional ethics committee approval and written informed consent, a single blinded randomized controlled trial was conducted on 60 patients scheduled for elective total hip replacement under general anaesthesia.

The sample size was calculated as 30 in each group based on the previous study[53] and a pilot study

Adults belonging to ASA grade I, II, III, body mass index less than 30 were included in the study. Those with ankylosing spondylitis, moderate to severe COPD, ASA grade IV, body mass index more than 30, were excluded from the study.

Patients were randomly allocated to receive either general anaesthesia combined with a continuous lumbar plexus block (n=30 patients) or general anaesthesia combined with continuous lumbar epidural block.

All patients were premedicated with diazepam 10mg and metaclopramide 10mg orally an hour before surgery.

In group-L (Lumbar plexus), the patient was positioned laterally with the operative side upper most**.** To locate the puncture site, Capdevila's landmarks were used. A line was drawn connecting the iliac crests (intercristal line). The

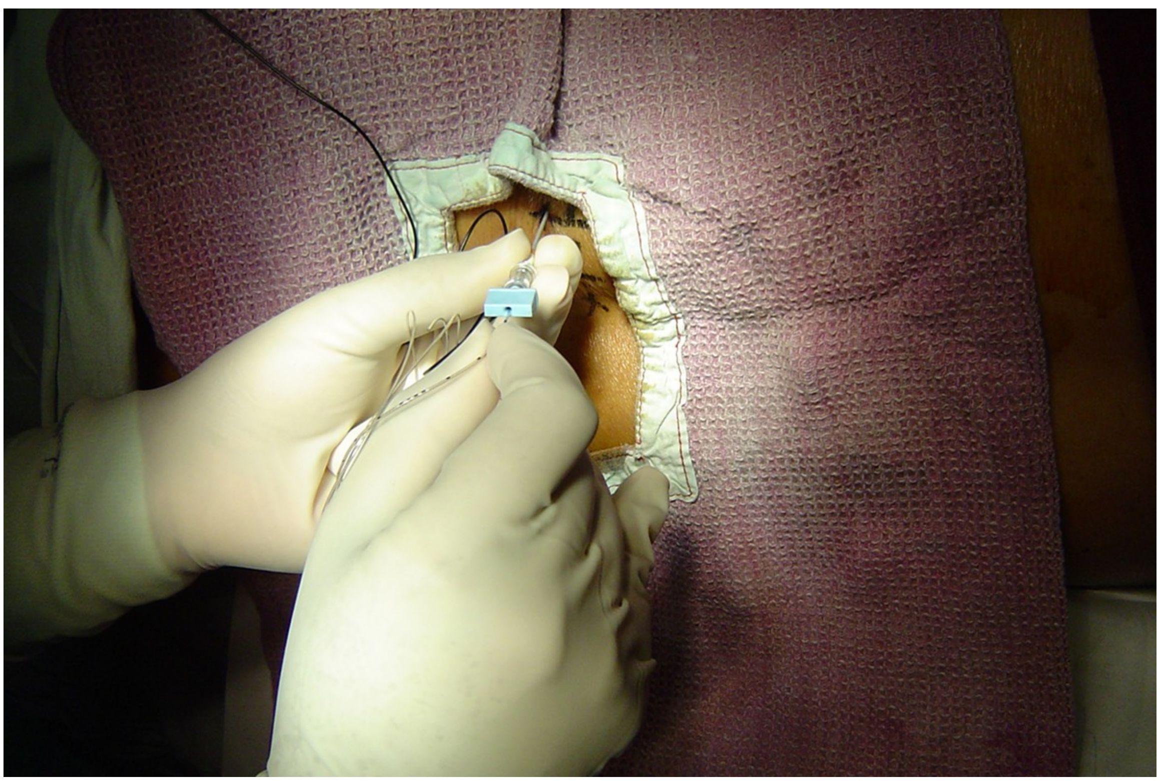
Capdevila`s Landmark

Tray for lumbar plexus block

spinous process was marked, and the posterior superior iliac spine (PSIS) was identified. A line passing through the PSIS was drawn parallel to a line joining the spinous process. The point of needle insertion was at the junction of the lateral third and medial two-thirds of a line between the spinous process and the PSIS and 1cm cephalad to the intercristal line. The needle was inserted perpendicular to all planes**.** Proper placement of the needle tip in the psoas compartment was confirmed by contraction of the quadriceps femoris muscle with the use of a nerve stimulator, delivering 0.2 – 0.5mA impulses at 2Hz linked to a 18g, 100mm stimulating needle.

5ml of normal saline was injected to expand the space and a 20g catheter was threaded through the needle. 5-7 cm of catheter was placed inside the psoas compartment. After aspiration to ensure absence of blood or cerebro spinal fluid, 3ml of 2% lignocaine with adrenaline 1:200,000 was injected as a test dose. The patient was observed for any untoward complication like neuraxial spread and intravascular injection. While maintaining a verbal contact, 20ml of 0.5% bupivacaine was injected in incremental doses. The onset of block was assessed by loss of sensation to cold in the region of the femoral, lateral cutaneous nerve and obturator nerve distribution. This was followed by a standard general anaesthetic technique comprising of sodium thiopental 4 – 6mg / kg; 2µg / kg fentanyl and maintained with 0.5 – 1% isoflurane. Tracheal intubation was facilitated with 0.8 – 1mg / kg of vecuronium and lungs were mechanically ventilated to end-tidal CO_2 30 – 35 mm Hg.

Stimulating needle in position



Threading of catheter through the needle

The second bolus of 0.25% bupivacaine (20ml) was injected through the catheter after 2 hours. An infusion of 0.125% bupivacaine with fentanyl 1μg / ml was started at the rate of 7 – 10ml / hour for next 48 hrs.

In group-E (Epidural), the patient was placed laterally or in the sitting position. An 18g Tuohy neelde was used to locate the L3-L4 lumbar epidural space by loss of resistance technique. A 20g catheter was threaded through the needleand 4cm of catheter was passed into the epidural space. A test dose containing 2% lignicaine 3ml with adrenaline 1:200000 was injected through the epidural catheter.After ensuring there was no intravascular injection or Intrathecal spread 10 ml of 0.5 % bupivacaine was injected into the epidural space. The sensory level of epidural block was assessed by loss of sensation to cold. This was followed by a standard general anesthetic technique described in the group L. If the duration procedure was more than 2 hrs, a supplemental bolus dose of 0.25% bupivacaine was titrated based on the hemodynamic parameters.

During the operation mean arterial pressure, heart rate, Spo2 and ETCO2 were recorded at 3 minutes interval. Intraoperative blood loss was assessed by measuring blood in the suction container and estimation of blood loss in the surgical pads. All of them were transfused with one unit of blood. Crystalloid, colloid and further blood transfusion were guided by visible and the measured blood loss and by hemodynamic data.

The aim was to maintain the mean arterial pressure (MAP) between 70-100mm Hg. Each MAP drop below 30% of the baseline was treated with a 6mg of ephedrine IV bolus. Each MAP raise above 30% of the baseline was treated by administering 1μg/kg fentanyl IV bolus. At the end of surgery patient was extubated and transferred to post anaesthesia care unit (PACU).

Patients remain in the PACU and monitored until they met the recovery criteria like wakefulness, hemodynamic stability and ability to move their lower limbs.

In group E epidural infusion containing 0.1% bupivacaine with fentanyl 1µg /ml was started in the PACU at the rate of 5-8ml when the vital signs were stable.

Hemoglobin estimation was done by the portable Hemocue apparatus. If the patient's hemoglobin was below 10.5, they were transfused with one unit blood. The sensory assessment of blockade was done and any undesirable effects were noted. Vital sign assessment was carried out by nurses, who were blinded to the type of block performed.

In the ward analgesic requirement were evaluated by the nurses using the visual analog scale (VAS).The patient with VAS score more than 3 received the rescue analgesia of intramuscular injection of Pethidine 1mg/kg. Pain score, blood pressure and heart rate were monitored by nurses 4^{th} hourly for 48 hrs. Catheter related problems and any complications were monitored by the acute pain service (APS) team. Both the nurse and APS team were blinded to the type of block performed.

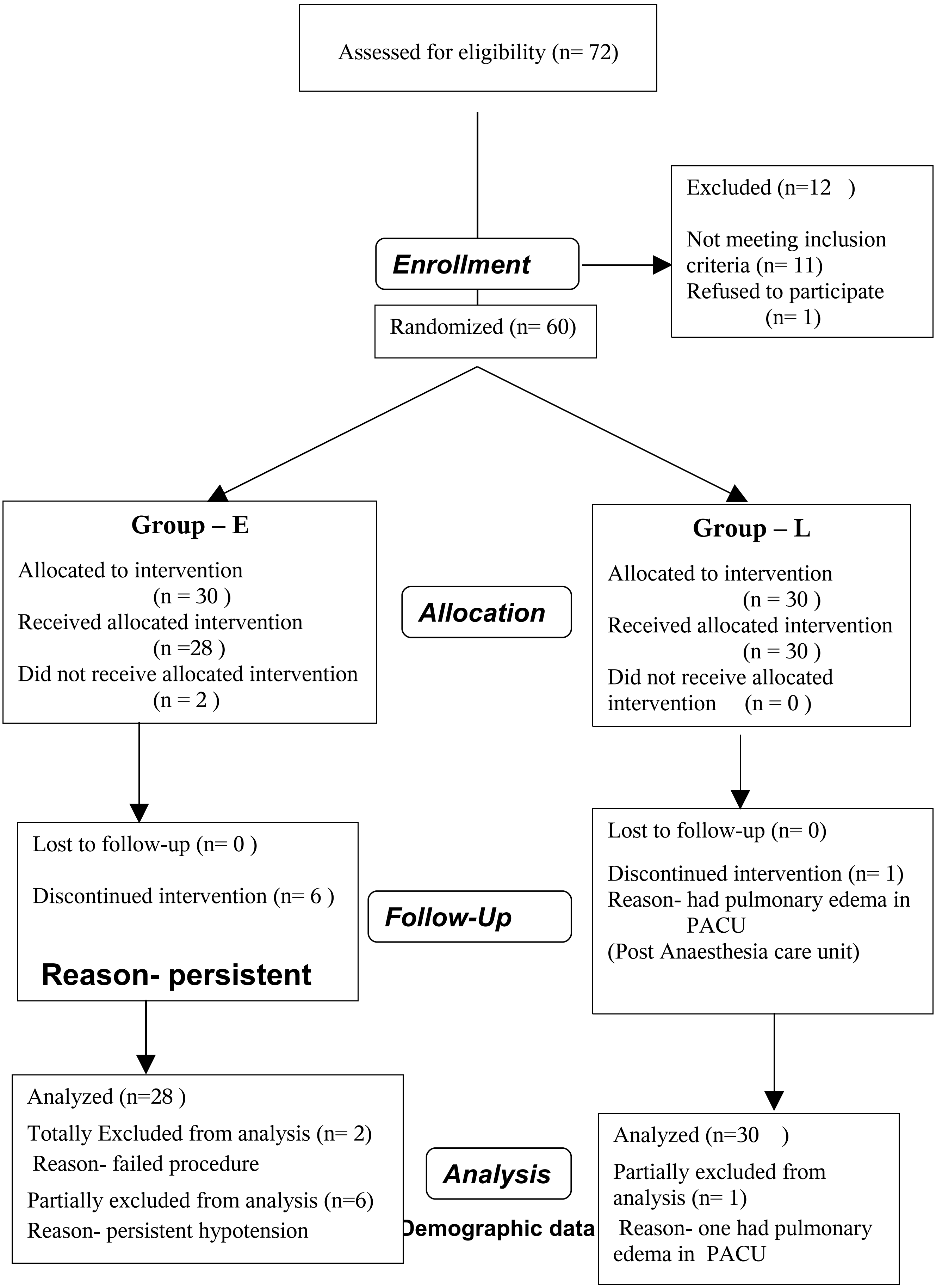
Data are presented as mean (standard deviation), median (range). Data was analyzed with the help of SPSS software using Mann and Whitney U test of Chi- square test as required. P value of less than 0.05 was considered.

RESULTS

A total of 72 patients were assessed for eligibility. Among them, 12 patients were excluded from the study because 11 of them did not satisfy the inclusion criteria and one patient refused to participate in the study. 60 patients were enrolled and randomized to two groups of 30 each.

In group-L all 30 were included in the analysis. Two patients were excluded from the post operative analysis as, one had pulmonary edema due to airway obstruction and inadequate reversal of neuromuscular blockade, and another patient's post operative data was found missing.

In group-E, two cases were excluded from the analysis due to failure of technique and six patients were excluded from the post operative period analysis due to discontinuation of infusion because of hypotension.


Assessed for eligibility (n= 72)
Enrollment
Excluded (n=12)
Not meeting inclusion criteria (n= 11)
Refused to participate (n= 1)
Randomized (n= 60)
Group – E
Allocated to intervention (n = 30)
Received allocated intervention (n =28)
Did not receive allocated intervention (n = 2)
Allocation
Group – L
Allocated to intervention (n = 30)
Received allocated intervention (n = 30)
Did not receive allocated intervention (n = 0)
Lost to follow-up (n= 0)
Discontinued intervention (n= 6)
Reason- persistent
Follow-Up
Lost to follow-up (n= 0)
Discontinued intervention (n= 1)
Reason- had pulmonary edema in PACU
(Post Anaesthesia care unit)
Analyzed (n=28)
Totally Excluded from analysis (n= 2)
Reason- failed procedure
Partially excluded from analysis (n=6)
Reason- persistent hypotension
Analysis
Demographic data
Analyzed (n=30)
Partially excluded from analysis (n= 1)
Reason- one had pulmonary edema in PACU

	Group E (n=30)	Group L (n=30)
Age (Yrs.)		
Mean	45.83 ± 13.06	40.20 ± 14.00
Range	24-73	20-74
Sex:		
Male	20	23
Female	10	7
Body Weight (Kg)		
Mean	59.80 ± 1.70	57.40 ± 2.16
Range	36-85	37-87
Height (cm)		
Mean	163.57 ± 1.08	165.13 ± 1.31
Range	150-175	150-176
BMI (kg/m^2)		
Mean	22.16 ± 0.57	20.88 ± 0.56
Range	15-30.5	15.4-28.1
ASA Risk I /II /III (In no.)	20 / 9 / 1	22 / 8 /0

There were no significant difference in age, sex, weight, height and body mass index distribution between the two groups.

Table 2: Procedure Variables

	Group E (n=28)	**Group L (n=30)**	**P value**
Time taken to site the Catheter (in mins.) (mean ± SD)	18.38 ± 10.1	16.77 ± 3.75	0.417
No. of Attempts (mean ± SD)	1.97 ± 1.09	1.97 ± 0.14	1.00
Intravascular (in no. & %)	3(10.3%)	2(6.7%)	0.612
Intrathecal (in no. & %)	1(3.4%)	0	0.315
Difficulty in Threading the Catheter (in no. & %)	3(10.7%)	3(10%)	0.929
Failed technique (in no.)	2	0	0.15

The time taken to site the catheter, number of attempts, intravascular placement of needle or catheter and difficulty in threading the catheter were comparable in both the groups. In the epidural group, two cases were excluded because of, one had a dural puncture and the other had difficulty in locating the epidural space.

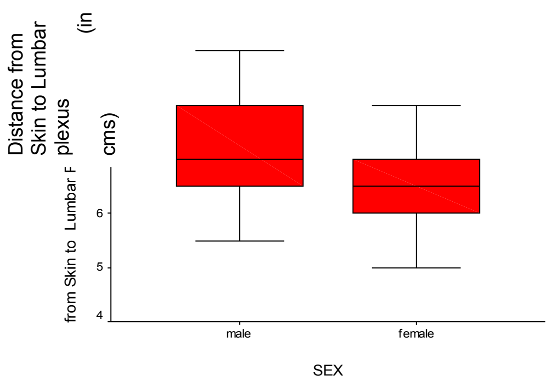
Table 3. Depth of lumbar plexus

Needle depth (in Cms)	Male	Female	P value
From skin to transverse process (mean ± SD)	5.17 ± 0.87 n = 19	4.50 ± 0.94 n = 6	0.121
From skin to lumbar plexus (mean ± SD)	7.17 ± 0.89 n = 23	6.50 ± 1.00 n = 7	0.102

In group-L, the mean depth of lumbar plexus was 7.17cm in male and 6.5 cm in female. The distance between the transverse process to lumbar plexus was 2cm for both male and female.

In 80%, the lumbar plexus was located by caudal or cephalad angulation of the needle after striking the transverse process of L-4 or L-5 and in 20% of the patients, the plexus was located without striking the transverse process.

Mean depth of lumbar plexus between male and female



Difference between male and female in the length

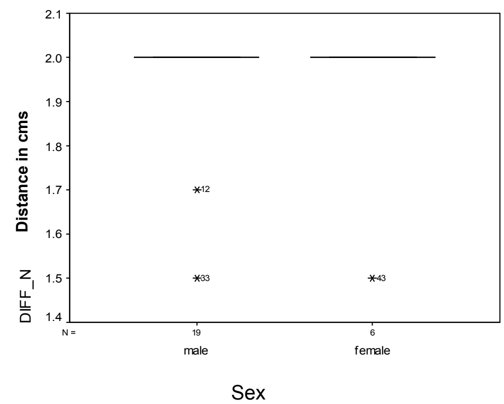


Table 4: Sensory distribution in lumbar plexus block

Branches	**n**	**% of blockade**
Femoral nerve	30	100%
Lateral cutaneous nerve	28	93.3%
Obturator nerve	27	90%

The nerves blocked by lumbar plexus were femoral 100%, lateral cutaneous nerve 93% and obturator nerve 90 %.

Table 5: Intra operative variables

	Group E (n=28)	Group L(n=30)	P value
Duration of Surgery (In mins.)	146.79 ± 10.86	144.00 ± 8.61	0.840
Blood Loss (in ml)	937.50 ± 88.9	953.33 ± 67.07	0.887
Incidence of Hypotension (in no. & %)	19 (67.9%)	7 (23.3%)	0.001 *
Mean dose of Ephedrine Supplementation (in mg.)	17.32 ± 19.03	2.37 ± 6.403	0.000 *
Crystalloids (in ml)	1267.86 ± 396.3	1170.00 ± 49.6	0.275
Colloids (in ml)	616.07 ± 300.32	500.00 ± 131.30	0.059

**=p<0.05 Significance*

All data are expressed as mean ± SD (except Incidence of Hypotension)

There was no significant difference between two groups regarding the duration of the surgery and blood loss. The mean dose of ephedrine requirement was significantly (P < 0.000) high in group-E. The requirement of crystalloids and colloids were less in lumbar plexus but statistically not significant.

Table 6: Intra operative Mean Arterial Pressure and Heart Rate (mean ± SD)

Time (in mins)	Group E (n=28)	Group L (n=30)	P value	Group E (n=28)	Group L (n=30)
	MAP	MAP		Heart Rate	Heart Rate
Base Line	97.18 ± 7.87	94.43 ± 8.26	0.201	80.00 ± 7.32	81.90 ± 6.85
0	84.68 ± 8.98	81.2 ± 13.94	0.267	88.82 ± 15.87	82.30 ± 16.21
10	76.46 ± 10.78	78.57 ± 14.75	0.541	92.68 ± 17.37	83.30 ± 13.83
20	70.57 ± 60.57	77.40 ± 16.46	0.131	92.25 ± 19.36	88.47 ± 15.98
30	63.36 ± 11.17	67.93 ± 12.66	0.151	90.29 ± 21.61	84.63 ± 16.10
40	64.18 ± 9.76	69.33 ± 10.9	0.064	86.43 ± 19.93	82.00 ± 15.89
50	63.36 ± 12.24	75.73 ± 12.46	0.000 *	82.57 ± 16.07	79.80 ± 15.21
60	64.18 ± 11.85	75.03 ±12.98	0.001 *	82.86 ± 15.75	79.20 ± 14.43
70	66.36 ± 15.08	74.93 ± 11.62	0.018 *	84.39 ± 16.62	80.53 ± 15.78
80	61.75 ± 10.29	71.70 ± 10.67	0.001 *	80.68 ± 15.46	78.63 ± 14.59
90	64.11 ± 9.44	70.30 ± 10.02	0.019 *	79.86 ± 15.23	78.47 ± 14.41
100	64.71 ± 12.60	70.17 ± 8.84	0.060	81.21 ± 14.26	78.43 ± 14.73
110	67.15 ± 11.71	72.66 ± 11.73	0.085	81.26 ± 13.77	78.76 ± 15.66
120	66.08 ± 10.99	69.87 ± 9.98	0.219	79.16 ± 13.35	77.17 ± 14.24
130	66.78 ± 8.74	68.26 ± 8.91	0.188	81.22 ± 13.10	77.35 ± 14.07
140	66.48 ± 12.06	73.00 ± 12.32	0.091	82.10 ± 14.12	76.10 ± 14.53
150	66.74 ± 13.25	73.84 ± 13.30	0.108	80.37 ± 15.33	78.00 ± 14.41

* p<0.05 Significance

Note: MAP – Mean Arterial Pressure.

The incidence of hypotension was significantly high in group-E (P<0.001) at 50 to 90 minutes after the start of general anaesthesia.

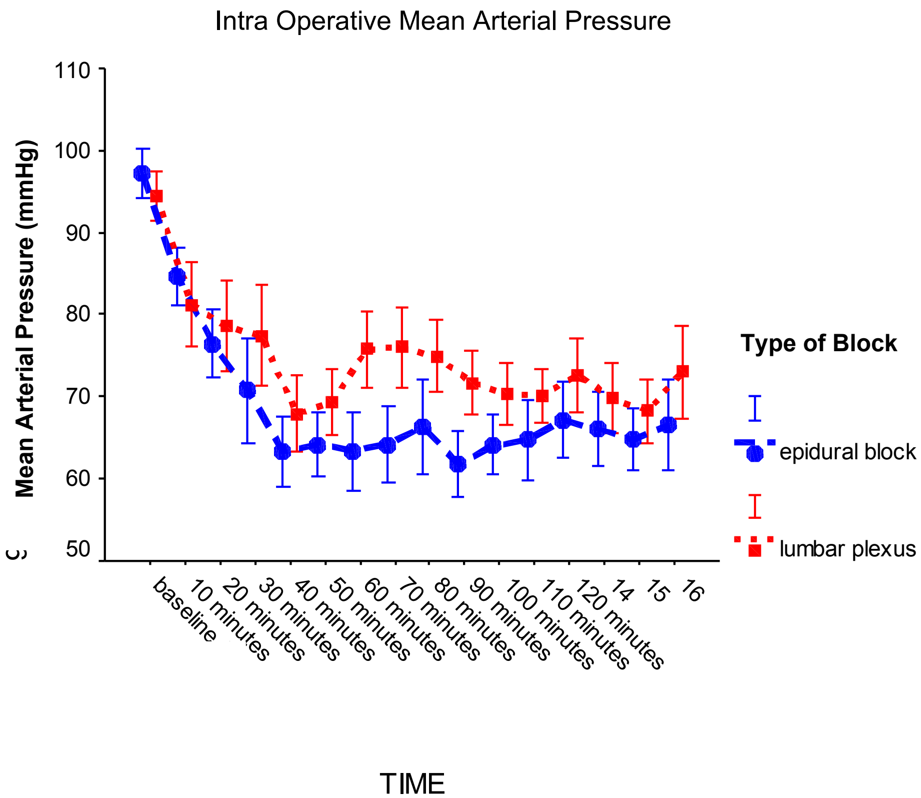


Table 7: Post Anaesthesia Care Unit Variables

Parameters	Group E (n=25)	Group L (n=29)	P value

Duration of Stay in mins. (mean ± SD)	119.60 ± 50.37	111.21 ± 35.19	0.476
Incidence of Hypotension (in no. & %)	6 (22.2%)	1 (3.6%)	0.036 *

In post anaesthesia care unit, the duration of stay was comparable in both the groups. The incidence of hypotension was significantly more in group-E (P<0.036), whereas only one patient had hypotension in the lumbar plexus group.

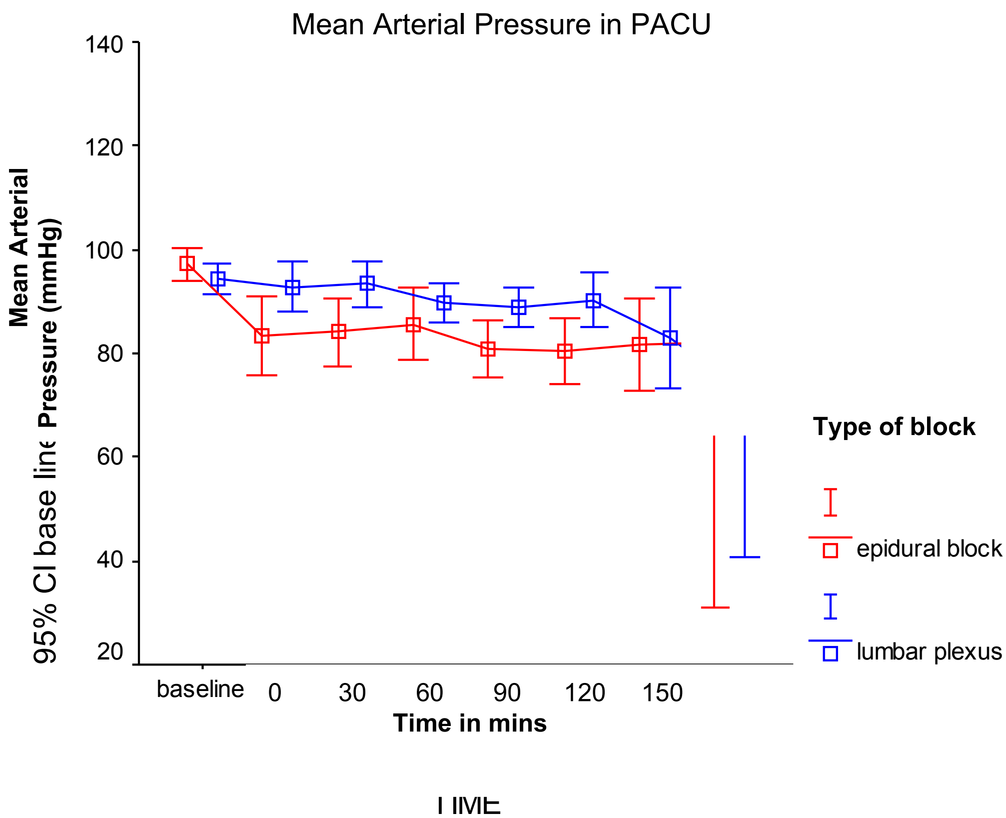
Table 8: Mean arterial pressure and heart rate in Post Anaesthesia Care Unit (mean ± SD)

Time (in mins.)	Group E (n=25) MAP	Group L (n=29) MAP	P value	Group E (n=25) Heart Rate	Group L (n=29) Heart Rate
0	83.36 ± 18.19	92.76 ± 12.69	0.030 *	91.52 ± 17.74	89.45 ± 15.29
30	84.12 ± 15.99	93.34 ± 11.94	0.019 *	87.12 ± 18.17	85.62 ± 13.12
60	85.61 ± 16.37	89.66 ± 9.65	0.272	86.17 ± 17.64	84.24 ±12.50
90	80.94 ± 10.94	89.00 ± 8.99	0.012 *	90.61 ± 18.07	82.58 ±12.46
120	80.40 ± 11.59	90.27 ± 7.86	0.023 *	90.87 ± 17.54	79.45 ± 11.85
150	81.57 ± 9.58	83.00 ± 9.40	0.792	86.43 ± 17.25	83.83 ± 13.55

**=p<0.05 Significance*

Note: MAP – Mean Arterial Pressure.

Compare to group L, group E had statistically significant drop in the mean arterial pressure from baseline at 0, 30, 90, 120 mins, but clinically that was not significant.



Mean Arterial Pressure in PACU
140
120
100
80
60
40
20
Mean Arterial Pressure (mmHg)
95% CI base line
baseline
0
30
60
90
120
150
Time in mins
Type of block
epidural block
lumbar plexus
TIME

Table 9: Pain Score in Postoperative Ward (in mean ± SD)

Time (in hrs.)	Pain Score		P value
	Group E (n=22)	Group L (n=29)	
0	1.67 ± 2.25	1.46 ± 1.73	0.710
8	0.78 ± 1.456	0.75 ± 0.967	0.934
16	0.56 ± 1.28	0.46 ± 1.03	0.772
24	0.33 ± 0.70	0.32 ± 0.54	0.946
32	0.87 ± 1.79	0.29 ± 0.60	0.112
40	0.50 ± 1.10	0.18 ± 0.47	0.171

The pain score was similar in both the groups.

Post operative pain score

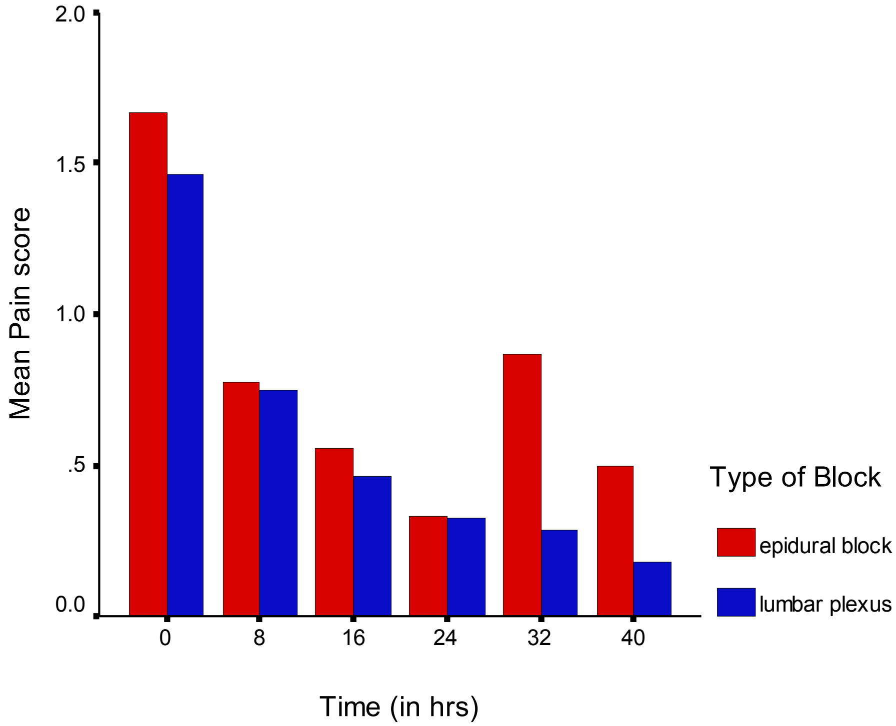


Table 10: Postoperative Complications

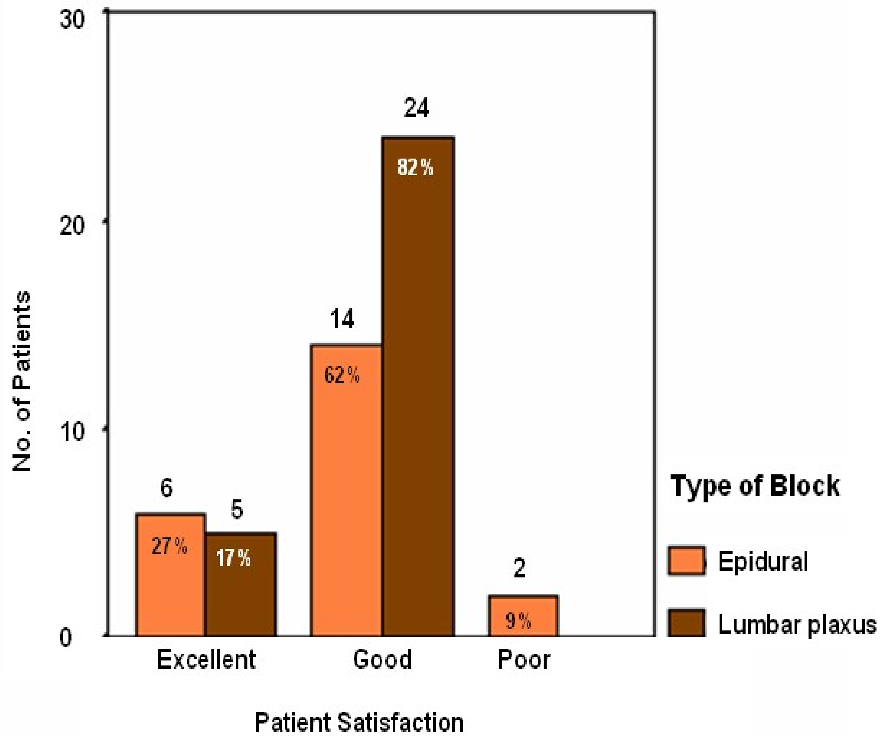
Parameters	Group E (n=28)	Group L (n=29)	P value
Hypotension	7 (25.0%)	1 (3.4%)	0.019 *
Discontinuation of infusion due to hypotension	6 (21.4%)	0	0.009 *
Urinary dysfunction	14 (50%)	7 (24.1%)	0.043 *
Nausea-Vomiting	7 (25.0%)	8 (27.6%)	0.825
Pruritus	6 (21.4%)	1 (3.4%)	0.039 *
Subarachnoid migration of catheter	1	0	0.305
Dislocation of catheter	5 (17.9%)	2 (6.7%)	0.191
Mean dose of pethidine supplement (in mg)	17.59 ± 44.83	8.62 ± 19.22	0.329
Number of complete unilateral epidurals	7 (25%)		
Number of epidural spread		1 (3.4%)	

* p<0.05 Significance

All variables are expressed in terms of number & percentage except pethidine dose as mean

In the post operative ward, the incidence of hypotension (P<0.019), discontinuation of infusion (P<0.009), pruritus (P<0.039) and urinary dysfunctions (P<0.043) were significantly high in group-E. In group-L incidence of urinary retention, dislocation of catheter and post operative pethidine requirements were comparatively less. A patient with subarachnoid migration of catheter developed blister in the gluteal region which was confirmed by biochemical analysis of cerebro spinal fluid for sugar and protein content.

25% of group-E had unilateral spread to the operated side and were totally pain free. 10 % of group-E had lateralization on non-operated side and required more opioid for pain relief. One patient in group-L had epidural spread to L4 dermatome of the contra lateral side.



The epidural pain relief was rated excellent by 27% of the patients, good by 63% and poor by 9% and the lumbar plexus block was rated as excellent by 17% and good by 83%.

DISCUSSION

Total hip replacement has been a major advancement in the treatment of chronic arthritis of hip and provides pain relief and increase mobility. Total hip replacement involves the prosthesis replacement of femoral and acetabular component of hip joint. There is significant operative trauma to both soft tissue and bone marrow with resultant haemorrhage.[1]

Spinal, epidural and various techniques of general anaesthesia have been used successfully for total hip replacement. The major intraoperative anaesthetic concerns are blood loss, cardiovascular instability and hypoxaemia. The blood loss is variable, averaging 0.5L – 1.5L intraoperatively and 300 – 500ml in the post operative period.[3]

Anaesthetic technique is an important factor affecting blood loss during total hip replacement. Intraoperative blood losses are significantly reduced with spinal and epidural techniques when compared with general anaesthesia alone.[4, 59]

Patients undergoing total hip replacement experience substantial and sustained post operative pain. Inadequate analgesia may limit early mobilization, impede the physical therapy and delay the discharge.[60] Postoperative pain relief is achieved by varieties of techniques such as IV PCA with morphine, epidural and continuous perineural blockade.[5, 54, 58] Each had its advantages and disadvantages. IV PCA with morphine is inefficient for pain relief during movement and ineffective in preventing the reflex spasm of quadriceps muscle, which is frequent after hip surgery. The benefit in consistency of pain control that epidural analgesia provides is offset by high incidence of catheter related problems and side effects such as urinary retention and hypotension.[6] Continuous lumbar plexus block has emerged as an alternative analgesic approach with continuous, efficient, and consistent pain relief and as good as continuous lumbar epidural block. In several studies unilateral lumbar plexus block provided a similar quality of analgesia like epidural, but with fewer side effects.[53, 55, 57]

Lumbar plexus block is technically easy to perform in patients with ankylosing spondylitis and elderly age group with calcified spinal ligaments. It can be performed in the lateral position and does not require hip flexion.

The X-ray of the pelvis with the lumbosacral spine served as a guide in localizing the L-4 spine and the transverse process. In our study, by using this simple landmark assessment 100% success was achieved in lumbar plexus block without any complication. So far various techniques like parasthaesia by Winnie[11], loss of resistence by Chayen[12] and the use of nerve stimulator by many others. And also, lots of modification in the landmark has been performed to reduce the failure rate and the complications of the block.

We have used Capdevila's [24] approach to locate the lumbar plexus and the sensory block of femoral nerve, lateral cutaneous nerve and obturator nerve was successful with 100%, 93% and 90% respectively in this study compared with that of Capdevila's [24] study with 95%, 85% and 90% respectively.

Similar to Capdevila's [24] study the difference between the depth of the transverse process and the lumbar plexus was 2cms in both male and female patients.

Rapid and painless recovery is the main advantage in combining general anaesthesia with epidural technique. But this combination causes more severe hypotension than is observed, when either method is used alone. The reason for this, large drop in pressure is because of the negative inotropic effect of general anaesthesia which is augmented by peripheral vasodilatation effect of epidural anaesthesia. Healthy and young individuals tolerate these effects well, where as in elderly patients with intravascular volume deficit, the combination of general anaesthesia and epidural may lead to hemodynamic instability.

In contrast to epidural block, the lumbar plexus block is reported to cause limited unilateral sympathectomy and therefore only minimal hemodynamic alterations. In our study, the mean arterial blood pressure at 50-90 minutes after the start of general anaesthesia revealed significant drop in arterial blood pressure in the patients who were given a general anaesthesia with epidural block than those who were given general anaesthesia with lumbar plexus block. These decrease in blood pressure occurred in spite of preoperative volume loading with IV crystalloids 10ml / kg. In the epidural group 67%of patients had significant hypotension compared to 23% in lumbar plexus block. This is statistically significant and this finding correlated well with the previous study [53].The ephedrine requirement in the epidural group, to treat the hypotension was significantly high with a mean dose of 17mg whereas it was 2mg in lumbar plexus group.

In the epidural group, due to the persistent hypotension 6 patients had discontinuation of infusion in the ward and were provided with other modes of pain relief. None of the patients in lumbar plexus group had such a complication.

Urinary retention in the postoperative period is common in the elderly age group done under epidural anaesthesia. William et al [61] reported urethral catheterization 67% and Singelys et al [54] reported 40% of similar incidence in the epidural group. In our study urinary dysfunctions like urinary retention and urinary incontinence were observed in 50% of the epidural group. Incidence of pruritus was significantly high in epidural group.

The reported incidence of epidural spread varies from 1-16%.[13, 23, 32] In our study, only one patient had epidural spread to L-4 dermatome in the contralateral side. The body mass index of that patient was only 18. A bolus of 20ml bupivacaine must have been a larger volume for her weight. The same patient underwent similar procedure a week later and had lumbar plexus block with a bolus of 15ml of 0.5% bupivacaine without epidural spread. When continuous nerve block technique is compared with single shot technique the incidence of epidural spread is less because lesser volumes are used. The entry point of the needle close to the midline has more chances of epidural spread.[62] In the epidural group 25% had complete unilateral blockade.

Contractions of quadriceps muscle with the nerve stimulator, indicates that the needle tip is located in the middle of lumbar plexus far from the paravertrebral space. In our study we injected the local anaesthetic when the contractions of the quadriceps muscle with nerve stimulation were seen and only one had epidural spread.

Side effects related to lumbar plexus block are quite severe. Auroy et al [34]published a retrospective study on complications of regional anaesthesia in France. A total of 394 posterior lumbar plexus blocks were performed. Among those patients, 1 cardiac arrest, 2 respiratory failures, 1 seizure, and 1 death occurred. Whereas in our study we had no such complications apart from one case of epidural spread. Test dose with adrenaline detects intravascular injection and intrathecal spread which provided safety for our patients. This is the single most important precaution, which can be undertaken to avoid untoward events like cardiac arrest, seizures, and death.

Macaire et al made a multinational retrospective study and they reported 4,319 posterior lumbar plexus blocks. Teams declared 1% to 10% of epidural spread. Other complications included 25 spinal anaesthesia (with 11 total spinal anaesthesia and 1 death), 13 intravascular injections (with 3 seizures and 1 cardiac arrest), 4 delayed toxic reactions, and 13 incorrect catheter paths. Whereas in our study, no such complications occurred presumably because of small sample size.

The persistence of myotonic response with nerve stimulation after injection of 1ml local anaesthetic should alert the anaesthesiologist to a possible intravascular injection. Deep sedation can mask the symptoms of systemic local anaesthetic toxicity. It highlights the importance of patient monitoring after the block and during catheter maintenance.

Deep vein thrombosis is common after total hip replacement affecting 60% of patients and approximately 20% of patients have evidence of pulmonary embolism by lung scan.[10] We found that lumbar plexus block is as effective as epidural in preventing deep vein thrombosis. The mechanisms in preventing deep vein thrombosis are the same as epidural, namely the local anaesthetic effect on the rheology and by early mobilization of the patients. None of our patients had deep vein thrombosis

Lumbar plexus block is better to be avoided in anticoagulated patient. Renal capsular hematoma has been described after the block at L-3 level.[37] That is why we performed the block at L-4.

The patient satisfaction was better in the lumbar plexus block which was rated good by 85% of the patients and only 63% for the epidural block.

CONCLUSION

Continuous lumbar plexus block is a superior alternative technique to continuous epidural block in the intra operative and post operative management of total hip replacement. It provides better hemodynamic stability, decreased incidence of urinary dysfunction and analgesia which is as good and sustained as epidural analgesia. The success rate is 100% with the use of a nerve stimulator, and the incidence of complications can be reduced by careful titrated doses of local anaesthetic, coupled with good vigilance and monitoring.

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Posters (part 2)

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ONTINUOUS POSTERIOR LUMBAR PLEXUS / EPIDURAL FOR THR

Patient Details

Name Hospital No MRD No

Age Sex

Weight Height Body Mass Index Date

Pre operative Assessment

***Diagnosis*:** 1.Ankylosing spondylitis 2.Arthritis 3.Traumatic 4. Redo

Type of surgery: 1.Cemented THR 2. Uncemented THR 3. Surface replacement

Comarbid Conditions: 1.Hypertension 2.DM 3.COPD 4.Others

HB PCV

ASA Risk: 1 11 111

Pulse Rate: B.P:

Lumbar Spine: 1.Palpable 2.With pressure palpable 3.Not palpable

X-Ray Finding Interlaminar space 1.Seen 2. Not seen

Distance between Spinous Process to

1. Lateral Border of L4 Vertebra 2. Tip of Transverse Process of L4 :

Procedure

Attempts: Duration : Minimum Current : Level :

Needle Depth from Skin to Transverse Process : Lumbar Plexus :

Needle direction: 1.Above L5 2. Below L4

Catheter Level At Skin Inside space :

Time of Test Dose : Bolus Dose : Infusion : Rate:

Patient co operation: 1. Very good 2. Good 3. Poor

Sensory Distribution Femoral N Level R L

LCT Nerve

Obturator N Onset time

Complication: 1. Intravascular spread 2. Intra thecal spread 3. Hypotension

Indication for contrast radiography: 1.failed blocks 2. Epidural spread

<u>Intra Operative</u> ***GA***

Duration of 1. Surgery: 2. Anaesthesia

Position: 1. Supine 2. Lateral

Total dose of Fentanyl : Morphine : Vecuronium :

Vasopressors :

IV fluids Colloid Blood

Blood Loss : 1.Intra operative 2.Draine collection

Blood Transfusion 1. Intra operative 2. Recovery 3. Post operative

Duration of stay in **recovery** : Hb

Intra operative vital signs :

Post operative HB PCV Fluids

Rescue analgesia

Day of 1.mobilization 2.Discharge

CONTINUOUS POSTERIOR LUMBAR PLEXUS / EPIDURAL FOR THR

Instruction to Acute Pain Service

This is a randomized controlled single blinded study of comparing Continuous Lumbar plexus and continuous epidural block for post operative pain relief for THR. In this the pain score and blood pressure recorded by staff nurse and sensory distribution and complication recorded by pain call. Both are blinded to the technique used. So any problems only see the anaesthesia sheet to know the procedure

Post operative complications:

1. Hypotension Treatment

2. Urinary retention 1. Passed with difficulty 2. Catheterized Voided Time

3. Nausea vomiting

4. Pruritus

5. Dislocated catheter

6. Lateralization on non operated side

7. DVT

8. Others

Patient satisfaction: 1. Excellent 2. Good 3.Poor

Sensory distribution