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A Comparative Study Between Three In One Femoral Nerve Block And PSOAS Compartment Block For Post Operative Analgesia In Orthopaedic Procedures on Femur

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Abstract

Aim: To evaluate the efficacy and duration of post operative analgesia for orthopedic procedures of femur using - Three in one nerve block versus psoas compartment block with 0.25% bupivacaine.

Materials and methods: This study was carried out in Orthopaedic Theatre, Azeezia Institute of Medical Sciences and Research; Meeyannoor; Kollam after obtaining Hospital ethical committee approval. The aim of the study was to compare the duration of post operative analgesia after orthopaedic procedure of femur using lumbar plexus block versus three in one nerve block and also to compare the time taken for the onset of block, using nerve locator. Selection of cases 50 patients belonging to ASA I & II who were to undergo elective orthopaedic procedure on the femur where chosen. All the patients were assessed and those with normal clinical and biochemical radiological and hematological parameters were selected. Informed written consent was obtained from all the patients.

Study Design: The study was done in a randomized fashion, patient were allocated to one of the two groups. Group I : Three in one nerve block Group II : Psoas compartmental block

Methods and preoperative preparation: Patients were assessed preoperatively. Procedure was explained to the patient and written informed consent was obtained. They were assessed with particular attention for any contraindication and exact weight was recorded. Overnight fasting was advised. Assessment of pain using modified 4 point verbal rating scale (Cheong et al 2001)14 was explained to the patient pre-operatively. Pain Score 0 - No Pain 1 - Mild Pain 2 - Moderate Pain 3 - Severe & Intolerable Pain Premedication All patient were premedicated with Tab.Diazepam 10mg the previous night.

Conclusion: Both the techniques (single shot 3 in 1 block or psoas compartment block) can be employed with general anaesthesia for post operative analgesia in orthopaedic procedures on femur. Psoas compartment

block with general anaesthesia is better than 3 in 1 block for post operative analgesia for orthopaedic procedures on femur.

Keywords: Psoas, Block, Femur, Bupivacaine.

Introduction

Peripheral nerve blocks can be used for doing surgeries or for post operative analgesia, depending upon the concentration of local anaesthetics used, if the surgery is to be performed involving the limbs. If it is a long (or) major procedure and requiring abnormal positioning, sole peripheral nerve block will be uncomfortable for the patient. If the procedure involves larger bones, like femur, which mostly requires lateral position, and duration is longer, it is always better to do it under general anaesthesia or spinal anaesthesia.

As the volume of drug which is needed for this procedure is very high if it is done solely under peripheral nerve blocks, it may cause toxicity of local anaesthetics. But peripheral nerve blocks of lower concentration, combined with general anaesthesia (or) sub arachnoid block will not cause toxicity, but provide a very good post operative analgesia. Major limb surgery is often painful and requires aggressive management. Post operative pain relief can be achieved by a variety of techniques including parental NSAIDS, epidural analgesia, patient controlled analgesia, IV analgesia with opioids. Peripheral nerve blocks are suitable substitutes for parenteral analgesics for post operative analgesia in lower limb surgery. The inguinal perivascular technique of lumbar plexus commonly known as '3 in 1' block has been shown to provide effective analgesia following hip and knee surgeries and surgeries on femur. Few investigators have questioned its efficacy due to incomplete block of obturator nerve, since it is mainly a motor nerve and gives some sensory branches. Failure to achieve block of this nerve may cause incomplete analgesia after hip surgery. An alternative technique for lumbar plexus analgesia is psoas compartment block. The present study was done to compare the efficacy of "3 in 1" versus psoas compartmental block in relieving post operative pain for orthopaedic procedures in femur.

Materials and Methods

This study was carried out in Orthopaedic Theatre, Azeezia Institute of Medical Sciences and Research; Meeyannoor; Kollam after obtaining Hospital ethical committee approval. The aim of the study was to compare the duration of post operative analgesia after orthopaedic procedure of femur using lumbar plexus block versus three in one nerve block and also to compare the time taken for the onset of block, using nerve locator. Selection of cases 50 patients belonging to ASA I & II who were to undergo elective orthopaedic procedure on the femur where chosen. All the patients were assessed and those with normal clinical and biochemical radiological and hematological parameters were selected. Informed written consent was obtained from all the patients.

Study Design: The study was done in a randomized fashion, patient were allocated to one of the two groups. Group I : Three in one nerve block Group II : Psoas compartmental block.

Group I: Received 0.25% bupivacaine 0.5ml / kg limited to 30 ml max – for 3 in 1 nerve block

Group II: Received 0.25% bupivacaine 0.5ml / kg limited to 30 ml max. for Psoas compartmental block

Inclusion criteria

1. Patient of physical status ASA I and II
2. Normal biochemical and hematological parameters
3. BMI < 30

Exclusion criteria

1. History of allergy to local anaesthetics

2. Bleeding diathesis
3. Neurological disorders
4. Local sepsis
5. Patient refusal
6. Technical failure

Materials : Materials include IV set up for infusion and resustication equipments including. Equipments Intubation set Masks, Airways, Endotracheal tubes Ventilation (oxygenation equipments) Drugs Local **Anaesthetics:** 0.25% Bupivacaine Adrenaline Hydrocortisone Vasopressor : Ephedrine Atropine, sedative (midazolam) Thiopentone sodium Succinyl choline Accessories : Antiseptic solution, sterile gloves. Patch electrode, marker pen Nerve locator (Fischer & Paykel) capable of delivering single twitch at 1 Hz with a current strength between 0.2 to 5.0 mA. Blunt tipped insulated nerve locator needle (Braun) with extension tubing for drug administration.

Preoperative Preparation: Patients were assessed preoperatively. Procedure was explained to the patient and written informed consent was obtained. They were assessed with particular attention for any contraindication and exact weight was recorded. Overnight fasting was advised.

Assessment of pain using modified 4 point verbal rating scale (Cheong et al 2001)14 was explained to the patient pre-operatively.

Pain Score 0 - No Pain 1 - Mild Pain 2 - Moderate Pain 3 - Severe & Intolerable Pain

Premedication: All patient were premedicated with Tab.Diazepam 10mg the previous night.

Conduct of anaesthesia: On arrival of the patient in the operating room, ECG, Pulse oximetry and blood pressure base line values were recorded. After explaining the procedure to the patient an intravenous access was obtained in the dorsum of the hand and intravenous infusion of Ringer lactate was started. Injection midazolam 0.05mg / kg and Inj. Fentanyl 1µg/kg glycopyrolate. 0.05mg/ kg were given to all the patients. Then they were given either 3 in 1 block (or) psoas compartmental block.

Three-In-One Nerve Block

Lumbar plexus lie in the fascial plane between the illacus and the psoas muscle The concept of the three-in-one block is to inject local anesthetic which should follow the fascial plane to the nerve roots (Brown, 1992)5

Positioning: Patient was positioned supine with 15^0 abduction of thigh on a flat surface. The inguinal region and thigh was thoroughly cleaned with Povidone iodine solution and sterile drapes were placed around the site.

Landmarks: Anterior superior iliac spine, pubic tubercle and femoral artery were identified.

Inguinal ligament: Line drawn between the anterior superior iliac spine and pubic tubercle. Femoral artery located at the mid inguinal point, femoral nerve lies lateral to the artery.

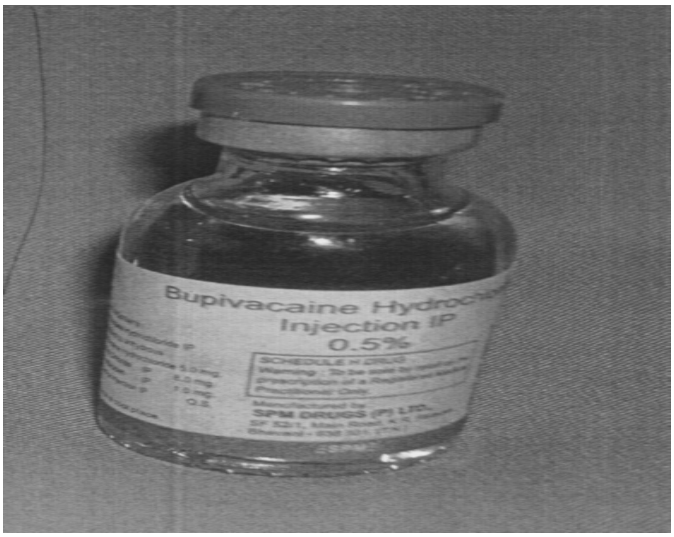


Fig 1: Bupivacaine vial

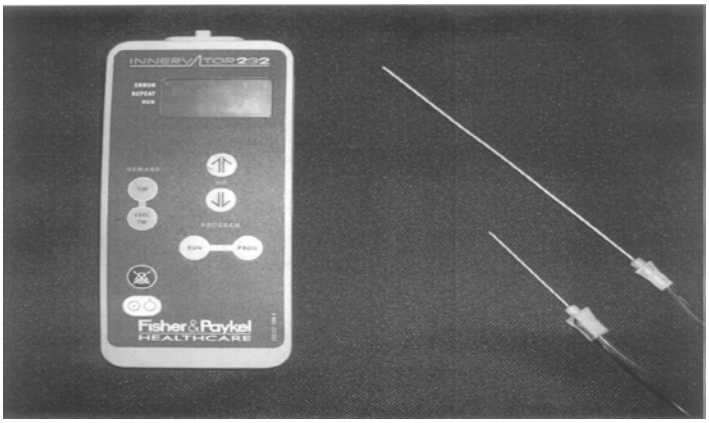


Fig 2: Nerve locator and Nerve locator needles.

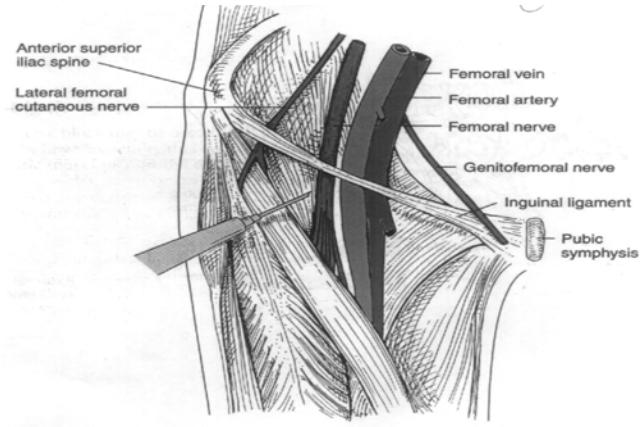


Fig 3: Three in one femoral nerve block

Procedure

Conductive patches were attached on the ipsilateral thoracic wall and connected to the nerve locator.

The site of puncture for entry into the perineural space of the femoral nerve is located approximately 1.5cm below the inguinal ligament and 1.5 cm lateral to the femoral artery. A 2 inch 22 gauge short bevelled Teflon – coated nerve locator needle with stimulator attached is advanced slowly at an angle of 450 to skin, parallel to the femoral artery in a cranio – dorsal direction. Once the needle is through the skin the nerve stimulation output is adjusted to 1-2 mA with a frequency of 1.0Hz. A motor evoked response of movement of patella indicates stimulation of femoral nerve. Once the nerve is located, the needle position is optimized and the stimulus intensity is reduced until a patellar twitch is present at an output of 0.4 – 0.6 mA. Upto this point three in one nerve and femoral nerve block are the same. After negative aspiration for blood, a volume of 0.5ml / kg upto a maximum of 30 ml of 0.25% bupivacaine was given with distal pressure to push the local anaesthetic upwards. With this volume, the local anaesthetic tracks along the fascial sheath to block the lumbar plexus. i.e., the obturator, the lateral femoral cutaneous and the femoral nerve.

Psoas Compartment Block

Anatomy. At the level of lumbar segments four and five (L4-5), the nerves of the lumbar plexus lie in a fascial sheath between the psoas and the quadrates lumborum muscles. Anesthetic injected into the sheath will bathe the three main nerves and possibly the sciatic nerve (Brown, 1992)5.

Technique Patients were placed in the lateral decubitus position with the side to be blocked uppermost. The skin over the area to be injected was prepared with antiseptic solution. A line was drawn between the iliac crests and midpoint at the fourth lumbar spine was marked. A second line was drawn five centimeters parasagitally to the midline. This identifies the injection site, at the intersection point of these two lines. A 22-gauge, four-inch Teflon coated needle was inserted. The transverse process of the lumbar fifth vertebrae was located with the needle. The needle was then slightly withdrawn and redirected cephalad until it slips past the transverse process. Now the nerve locator is set to deliver a current of 2mA at 1 Hertz frequency. Needle is advanced until lumbar plexus is located. Once the lumbar plexus is located, the twitch strength is decreased to 0.4 – 0.6 mA while adjusting the needle to maintain quadriceps contraction. The needle was then held in place and after negative aspiration for blood 0.25% bupivacaine 0.5ml/kg to the maximum of 30ml was injected with aspiration attempted after each five

milliliters. The lateral femoral cutaneous nerve innervates the skin of the lateral aspect of the thigh, the obturator nerve innervates the medial aspect of the thigh and the femoral nerve innervates the anteromedial aspect of thigh progressing to the medial aspect of the lower leg.

Evaluation

Both the groups were evaluated for

1. Time for performing the block (from the needle entry to completion of injection)

2. Time for onset of block (by loss of cold sensation)

After completion of blocks, patients were placed in supine and checked for loss of cold sensation using spirit in cotton, every 30 seconds. Lack of sensation for cold is taken as the time for onset of block. After evaluating the onset time, both groups were given general anaesthesia with controlled ventilation. Drugs used were thiopentone sodium, succinyl choline, fentanyl, non-depolarising muscle relaxant, rocuronium. Inj. Fentanyl – 1 µg/kg is given during induction, followed by intermittent incremental dose of 0.5µg/kg. The supplementation of fentanyl was not less than 45 min before the completion of surgery.

After completion of surgery, patients were reversed with neostigmine and glycopyrollate and extubated after adequate recovery. They evaluated for pain using 4 point verbal rating scale. (Choeng et al 2001)14

0 - No pain

1 - Mild pain

2 - Moderate pain

3 - Severe pain

They were assessed at 0 hour (Immediately after extubation), at 6 hours and time of onset of severe pain noted. If the patients have a pain score of 3 at 0 hour considered as block failure and excluded from study. If the VRS score is equal to 2, they will receive a dose of Diclofenac sodium. VRS > 2 will receive opoids (Pentazocine / Promethazine) and the time

noted. Local anaesthetic toxic reactions including subjective and objective manifestations like circumoral numbness, tinnitess, twitching, convulsion etc., if any were looked for and appropriate measure were planned. Any other complications like hematoma (or) bleeding were noted.

Parameters studied

1. Time for performing the block

Time from point of needle entry to the removal of needle after injecting local anaesthetic.

2. Onset of sensory analgesia.

This is the time in minutes (or) seconds from the injection of the drug to the lack of appreciation of cold sensation.

3. Duration of post operative analgesia

From extubation to onset of severe pain.

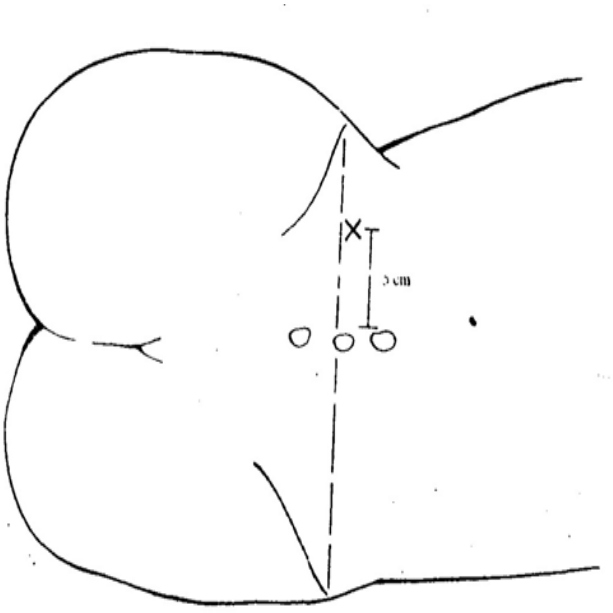


Fig 4: Surface Marking For PSOAS Compartment Block

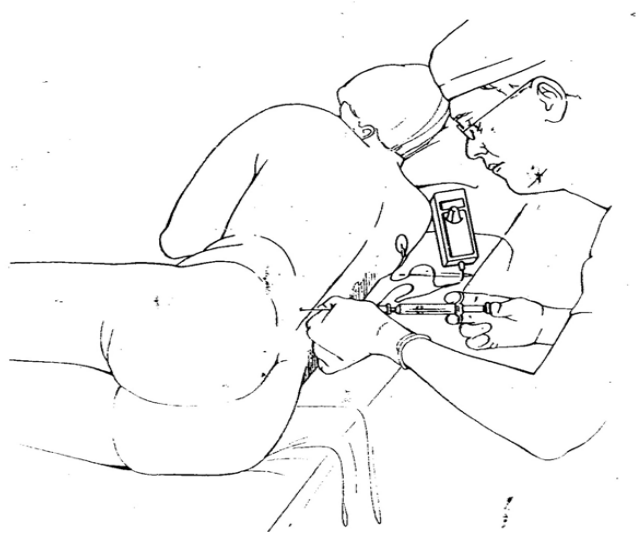


Fig 5: Performing Psoas Compartment Block Using Nerve Locator

Observation and Results

The patients included in the study were divided into two groups consists of 25 patients each.

Group I : Three in one nerve block

Group II : Psoas compartment block

Test Statistics

1. Chi – Square test
2. Two sample t test

TABLE 1: AGE DISTRIBUTION

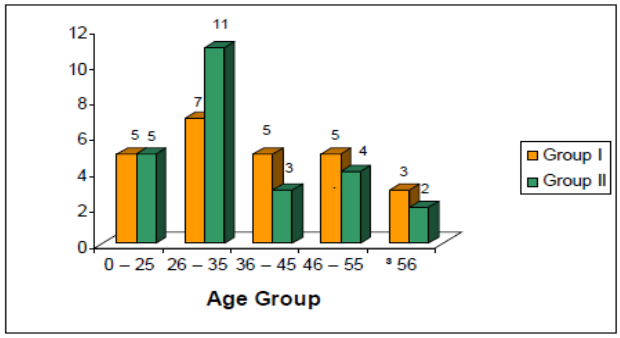
Age group	Group I	Group II
0 – 25	5	5
26 – 35	7	11
36 – 45	5	3
46 – 55	5	4
≥ 56	3	2
	25	25

Age	Mean ± S.E. of Mean
Group I	38.08 ± 2.663281
Group II	35.28 ± 2.755915

P. Value = 0.468580 – Not significant

(P < 0.05 is significant)

DISTRIBUTION OF AGE GROUP



DISTRIBUTION OF SEX

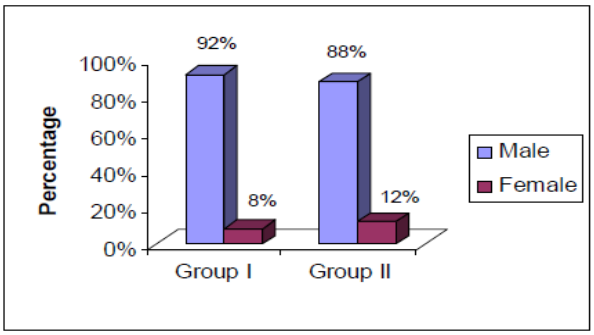


Table 2 :DISTRIBUTION OF SEX

Sex	Group I	%	Group II	%	Total
Male 1	23	92%	22	88%	45
Female 2	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.6374 – Not significant

TABLE 3 : DISTRIBUTION OF HEIGHT

Height	Mean ± S.E. of Mean
Group I	167.52 ± 1.213974
Group II	166.88 ± 1.23061

P value = 0.712835 - Not Significant

TABLE 4 : DISTRIBUTION OF WEIGHT

Weight	Mean ± S.E. of Mean
Group I	62.44 ± 1.397712
Group II	62.52 ± 1.297588

P value = 0.966715 - Not Significant

TABLE 5: DISTRIBUTION OF BODY MASS INDEX

BMI	Mean ± S.E. of Mean
Group I	22.28 ± 1.773276
Group II	22.4316 ± 2.117317

P value = 0.0791001- Not Significant

TABLE 6: DISTRIBUTION OF TYPE OF INJURY

Pathology Code	Group I		Group II		Total
	No. of Patients	Percentage	No. of Patients	Percentage	
1	17	68%	17	68%	34
2	5	20%	3	12%	8
3	1	4%	2	8%	3
4	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.793187 – Not significant

Pathology Code :

1 – Fracture Shaft of Femur, 2 – Supracondylar Fracture Femur,
3 – Trochantric Fracture Femur, 4 – Fracture Neck of Femur

TABLE 7: DISTRIBUTION OF SURGICAL PROCEDURE

Procedure Code	Group I		Group II		Total
	No. of Patients	Percentage	No. of Patients	Percentage	
1	9	36%	11	44%	20
2	4	16%	4	16%	8
3	3	12%	3	12%	6
4	7	28%	4	16%	11
5	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.8751 – Not significant

Procedure Code

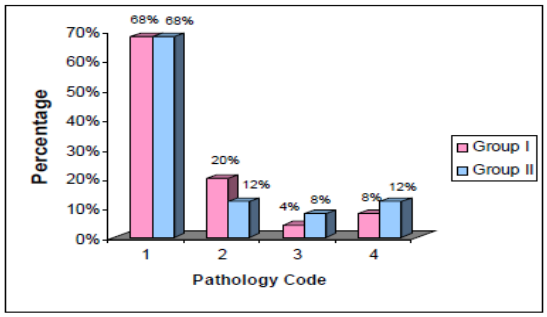
1 – Interlocking Nail, 2 – Intramedullary Nail, 3 – Plate and Screws
4 – Dynamic Compression Screws, 5 – Hemiarthroplasty

TABLE 8: DISTRIBUTION OF TIME FOR SURGICAL PROCEDURE (MINS)

Time	Mean ± S.E. of Mean
Group I	144.2 ± 3.325157
Group II	144.2 ± 3.453018

P value = 0.0678385 - Not Significant

DISTRIBUTION OF TYPES OF INJURIES



DISTRIBUTION OF SURGICAL PROCEDURE

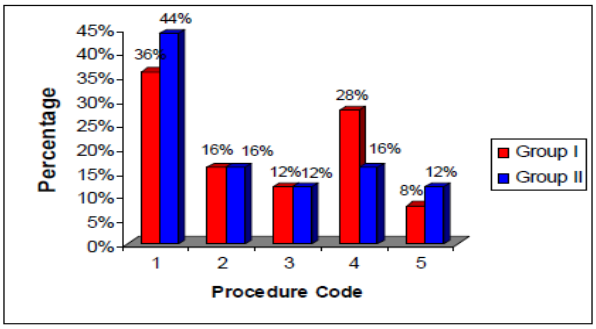


TABLE 9: DISTRIBUTION OF TIME FOR NERVE BLOCK (SECS)

Time	Mean ± S.E. of Mean
Group I	327.2 ± 7.773245
Group II	333.8 ± 11.04264

P value = 0.627254 - Not Significant

TABLE 10: ONSET OF ACTION (SECS)

Onset of Action	Mean ± S.E. of Mean
Group I	292.8 ± 7.2
Group II	292.8 ± 6.9885

P value = 0.000 - Not Significant

TABLE 11: PAIN SCORE AT 6 HOURS

Pain score	Group I	Group II	Total
0	15	18	33
1	8	7	15
2	2	0	2
Total	25	25	50

P value = 0.3704546 - Not Significant

Results and Conclusion

It is well known that orthopaedic procedures have high incidence of severe post operative pain and require adequate post operative analgesia11. The purpose of this study was to describe post operative pain relief associated with two different regional anaesthetic techniques of blocking the nerves of the lumbar plexus in patients undergoing orthopedic procedures on femur. The mean time for the performance of block on Group I (3 in 1 block) – 327.2 sec. The mean time for the performance of block on Group – II is 333.8 sec. (P value = 0.627254 – not significant , Table No.9). Mean time for the onset of block (assessed by loss of cold sensation) In Group I - 292.8 sec. Group II - 292.8 sec (P value = 0.0001) Statistically not significant

In this study the post operative analgesia (i.e. the time from the need for (opiods) analgesic) is about 562.6 minutes (9.376 hours), for patient who receive a 3 in 1 block with general anaesthetia undergoing surgery on femur.

In group II patients who receive psoas compartment block with general anesthesia, the mean duration of pain relief is 618.6 min (10.31 hours). The concept of pre-emptive analgesia implies that postoperative pain can be reduced if the nerve – transmission is blocked prophylactically, before the stimulus is presented. By using a regional technique, the pain signal is pre-empted in the neural circuit. The signal is never transmitted to the spinal cord and subsequently to the brain. The route of pain transmission and perception is never established. On the contrary, using general anaesthesia alone, the pain signal is transmitted, to be modified by other means.

In this study, on comparing the pain score at 0 hour, (immediately after extubation) in Group I no one felt pain. At six hours after extubation 8 patients had pain score of 1 and 2 patients had pain score of 2. But none had a pain score of > 2. Likewise in Group II 7 patients had pain of 1 and none had a pain score of 2 at 6 hours post operatively (P value = 0.37045 – not significant).

Low rate of analgesic requirements is consistent with earlier studies comparing patient controlled analgesia and lumbar plexus block for Anterior Cruciate Ligament reconstruction.

Matheney et al (1993)24 demonstrated that the average total dose of narcotic used for patients undergoing Anterior Cruciate Ligament reconstruction in the lumbar plexus blockade group was 10.1mg compared to the 91.9mg for the patient controlled analgesia group. This is beneficial to the patient as high dose of narcotic is frequently associated with side effects such as nausea, urinary retention, sedation and pruritis.

In this study only 8% Group I and 4% of Group II patients required analgesic within 6 hours (Diclofenac Sodium). Regional nerve blockade for knee surgery have been demonstrated to be consistently beneficial in controlling pain (Fournier et al, 1998)17. A common misconception is that they take too long to perform and can delay surgery.

Interestingly, the average time to perform 3 in 1 block is 327.2/60 sec (i.e) 5 min and 27 sec and psoas compartment block is 338 sec (i.e.) 5 min and 33 sec. If properly planned this amount of time should not delay the surgery, especially if the regional technique is combined with general anaesthesia. The nerve blockade should be evaluated before the induction of general anaesthesia, however it is not necessary for the blockade to completely take effect before surgery is begun. Complete blockade of the nerves will occur prior to the end of surgery, when it is necessary for control of post operative pain (Fournier et al 1998)17 (Captain Cheryl A Burch – 1999)13.

In this study, the length of time to administer the regional technique was short, which will encourage the use these procedures for post operative analgesia. Patients could arrive 15 – 20 minutes earlier than normally scheduled in anticipation of block administration.

In this study, we have included patients undergoing orthopaedic procedures on femur. Though the surgical procedure varies, duration of surgery does not differ grossly. We have included five different procedures on femur, in this study. The number of cases included in each group is comparable and there is no statistical difference between the groups.

We also compared the pain relief achieved by the two techniques for each orthopaedic procedure. Average duration of post operative pain relief is definitely longer in group II patients compared to group I patients.

Summary and Conclusion

On comparing '3 in 1' nerve block with posas compartmental block using 0.25% bupivacaine for post operative analegesia, in orthopaedic procedures on femur.

1. Time for performing the block is short and comparable in both techniques.

2. Onset of block is also short and comparable (using loss of cold sensation as end point) in both techniques.

3. Duration of time from the end of surgery to onset of severe pain is longer in group II patients (Psoas compartment group) than group I patients (3 in 1 group).

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