



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

Peripheral nerve blocks in lower concentration of local anaesthetics combined with general anaesthesia or subarachnoid block for surgery will not cause toxicity, but provide good postoperative analgesia.

AIM: Compare the efficacy of 3 in 1 versus psoas compartmental block in relieving postoperative pain for orthopaedic procedure in femur.

TYPE OF STUDY: 50 patients randomized into two groups. Group 1: 3 in 1 nerve block and group 2: psoas compartmental block.

METHODS: In Group 1: 0.5ml/kg upto a maximum of 30 ml of 0.25% bupivacaine was injected into the femoral nerve upwards, drug tracks along the fascial sheath to block lumbar plexus and ingroup 2 drug was injected into the psoas compartment.

RESULTS: Mean duration of postoperative analgesia in group 1 was 526.6 minutes and in group 2 was 618.6 minutes

CONCLUSION: Psoas compartmental block is better than 3 in 1 block for postoperative analgesia for orthopaedic procedures in femur.

KEYWORDS

Postoperative analgesia, 3in 1 block, psoas compartmental block

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. 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.

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.

AIM OF THE STUDY:

- 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.

The following parameters are compared

1. Time taken for performing the block
2. Time taken for the onset of block (loss of cold sensation)
3. Time from the end of surgery and the onset of severe pain requiring analgesics (Duration of post operative analgesia).

MATERIALS AND METHODS:

This study was carried out in Orthopaedic Theatre, Government villupuram medical college after obtaining Hospital ethical committee approval. 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.

STUDY DESIGN:

The study was done in a randomized fashion, patient were allocated to one of the two groups.

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 resuscitation 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)

Methods

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

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 iliacus 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

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 45° 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

Procedure:

Patients were placed in the lateral decubitus and a line was drawn between the iliac crests and midpoint at the fourth lumbar spine was marked. A second line was drawn five centimeters parasagittally 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 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 glycopyrolate 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 opioids (Pentazocine / Promethazine) and the time noted.

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 value <0.05 is significant)

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(MINUTES)

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

P value = 0.0678385 – not significant

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

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

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

TABLE 12: DURATION OF PAIN RELIEF (MINUTES)

Duration	Mean ± S.E. of Mean
Group I	562.6 ± 9.1566
Group II	618.6± 11.9147

P value = 0.000511 - significant

TABLE 13: DURATION OF PAIN RELIEF FOR DIFFERENT PROCEDURES

Procedure	Group	No. of Cases	Mean	Standard Error of Mean	P value
DCS	I	7	567.857	± 14.051	P = 0.179826 Not significant
	II	4	612.5	± 27.5	
Hemi arthroplast	I	2	585	± 15	P = 0.24989 Not significant
	II	3	630	± 22.91	
IM Nailing	I	4	556.25	± 14.63087	P = 0.041390 Significant
	II	4	631.25	± 25.03123	
IL Nail	I	9	559.4445	± 20.940	P = 0.101094 Not significant
	II	11	609.5455	± 19.8454	
Plate	I	3	553.333	± 30.867	P = 0.293613 Not significant
	II	3	631.666	± 57.03313	

DISCUSSION:

It is well known that orthopaedic procedures have high incidence of severe post operative pain and require adequate post operative analgesia. 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 – 327.2 sec

The mean time for the performance of block on Group – II is 333.8 sec. Mean time for the onset of block in Group I - 292.8 sec and in Group II - 292.8 sec

In this study the post operative analgesia is about 562.6 minutes (9.376 hours), for patient who receive a 3 in 1 block with general anaesthesia undergoing surgery on femur. In group II patients who receive psoas compartment block with general anaesthesia, the mean duration of pain relief is 618.6 min (10.31 hours). 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. Low rate of analgesic requirements is consistent with earlier studies comparing patient controlled analgesia and lumbar plexus block for Anterior Cruciate Ligament reconstruction.

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 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.

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.

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.

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