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Original Research Article

Combined psoas compartment block and sciatic nerve block versus unilateral subarachnoid block as a sole anaesthetic technique for lower limb orthopaedic surgery – A prospective randomised controlled study

Ankita Patel[1,*], **Kavita Lalchandani**[1], **Heli Mehta**[1]

[1] *Dept. of Anaesthesiology, Baroda Medical College and S.S.G. Hospital, Vadodara, Gujarat, India*

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ABSTRACT

Background and Aims: Nerve block as a part on regional anaesthesia extends analgesia time and gives better haemodynamic stability, so comparison of nerve block like psoas compartment block and sciatic nerve block with spinal anaesthesia is our main aim of study.

Materials and Methods: Total 96 patients of tibial surgeries with any gender of ASA grade I, II and III were assigned and randomly divided into two groups:- group P- psoas compartment block plus sciatic nerve block and group S-unilateral subarachnoid block. Parameters compared were onset, peak effect and duration of sensory and motor blockage, haemodynamic parameters, postoperative duration of analgesia and requirement of rescue analgesics post-operatively.

Results: Onset of motor and sensory block were faster in group S than group P. There was no significant difference in haemodynamic parameters in both the group. Duration of analgesia in group P was 16.79 ±2.3 hours as compared to group S was 5.57 ±0.49 hours, which was highly significant. Number of rescue analgesic required was significantly less in group P(1.10 ± 0.30) as compared to group S (3.04 ± 0.20) without significant complications in both the groups.

Conclusion: Combined psoas compartment block with sciatic nerve block provides prolonged duration of analgesia over subarachnoid block and less numbers of rescue analgesics required postoperatively with good haemodynamic stability.

1. Introduction

The interruption of pain pathways at multiple anatomic level and ability to provide excellent operating conditions without undue sedation or obtundation makes specific peripheral nerve blocks ideally suited for surgery of lower extremity.

The lower limb orthopaedic surgeries are very common in polytrauma patients, and these patients may be associated with vertebral fracture, head injury with subarachnoid haemorrhage, and hemodynamic instability.[1,2] The regional anaesthesia in the form of central neuraxial blockade or peripheral nerve block can be considered to be favoured technique for such surgeries unless contraindicated. The central neuraxial blockade has advantages like simple to administer, excellent sensory and motor block, preservance of consciousness and avoidance of complications of general anaesthesia, but it can also lead to complications like hypotension, urinary retention, nausea vomiting and neurological damage.[3] Complications of general and spinal anaesthesia can be avoided using peripheral nerve block technique. Ultrasound and peripheral nerve locator made easy, safer and successful technique for peripheral nerve block. Peripheral nerve blocks are associated with low incidence of perioperative complications, good

* *Corresponding author*.
E-mail address: anki.ap.105@gmail.com (A. Patel).

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postoperative analgesia, early ambulation and timely discharge.[4]

The first description of such a block by Winnie A et al. in 1973 was an "inguinal perivascular technique" alternatively referred to as a "3 in 1 technique.[5]

In 1976 Chayen et al. described a "posterior lumbar plexus block" or "psoas compartment block."[6] In 1923 Labat described "The classic approach of Labat" of Sciatic nerve block and then Alon Winnie eventually modified the Labat approach in 1975. George Beck described anterior approach of Sciatic nerve block in 1963.

Lower limb is supplied by nerve of sacral plexus and lumbar plexus, so blocking of these nerves can provide anaesthesia for lower limb surgery.

Psoas compartment block with sciatic nerve block is a modern anaesthetic technique for lower limb surgery. Psoas compartment block provides blockade of the entire lumbar plexus while sciatic nerve block provides blockade of lower limb below the knee. So, combining both these blocks can be used as sole anaesthetic technique for unilateral lower limb surgery.[7–9] Therefore, we decided to compare peripheral nerve block with central neuraxial block in parameters of sensory and motor blockage, Hemodynamic stability, Duration of analgesia, number of rescue analgesic required in 24 hours and perioperative complications.

2. Materials and Methods

This was a prospective, randomized, controlled time-bound study. Randomization was done using sealed-envelope method.

Total 96 patients in age group of 18 to 70 years of any gender and ASA I II III, posted for tibial surgery divided into two groups of 48. After obtaining permission from the Institutional Ethical Committee for Human Research, patients posted for tibial surgery were assessed day before surgery and procedure was explained. On the day of the surgery patients were shifted to the pre-operative room, after reassessment by the principal investigator. Patients not willing, Allergy to local anaesthetics, Contraindication of spinal anaesthesia, with coagulopathy, local infection, pre-existing neurological deficit, spine fracture, significant history of drug or alcohol abuse, psychiatric illness, Bilateral lower limb surgery, pelvic fracture because of position problems were excluded from the study. After confirming fasting status, a written informed consent was taken from each patient then patients were taken into O.T. Baseline parameters like electrocardiograph, spo2, non-invasive blood pressure were noted. The patients were randomly allocated into two groups of 48 patients each by using randomization like sealed envelope method:- Group P(n= 48) and group S (n= 48). An intravenous line was established using 18 or 20 G cannula and IV fluid was started. The patients were premedicated with Inj. Glycopyrrolate 0.2mg IV, Inj. Ondansetron 4mg IV, Inj. Midazolam 1mg IV 5 min before block. Group P (psoas compartment block and sciatic nerve block): received psoas compartment block and sciatic nerve block using peripheral nerve locator. Total 50cc of 20ml Inj. Bupivacaine (0.5%) and 20ml Inj. Lignocaine (2%) with Adrenaline (1:200000) and 10ml sterile water local anaesthetic solution were made. 25cc were given in psoas compartment block 25cc were given in sciatic nerve block. Group S received subarachnoid block with inj. Bupivacaine 0.5% heavy 1.5cc intrathecally in L3-L4 space in lateral position.

2.1. Method of psoas compartment block

Posterior approach was used for psoas compartment block. Position of patient -Lateral decubitus with the side to be operated uppermost and knee and hip were flexed at 90 degrees.[10] Points were marked –1) posterior superior iliac spine (PSIS) 2) Intercristal line. Line was drawn from the PSIS parallel to the spine in cranially and another line is intercristal line connecting iliac crest. Point of intersection of the two lines is the point of needle insertion. Under all aseptic and antiseptic precaution 10cm 22 G insulated needle connected to nerve locator set at 3mA frequency was inserted at the point of insertion and motor response of quadriceps muscle with current below 0.5mA were accurate point of insertion. Once it appeared after negative aspiration LA injected gradually with frequent aspiration to watch for blood.

Fig. 1: Approach for psoas compartment block

3. Method of sciatic nerve block

Classical Labat's approach was used for sciatic nerve block for complete lower limb anaesthesia.[11] Position of Patient - same as psoas compartment block. Two lines were drawn:- 1) from the greater trochanter to the sacral hiatus and 2) greater trochanter to the posterosuperior iliac spine (PSIS). A perpendicular line was drawn from the midpoint of the greater trochanter-PSIS line caudally that intersected the greater trochanter-sacral hiatus line. This represents the

point of needle insertion. Under all aseptic and antiseptic precaution insulated needle was connected to nerve locator set at 3mA inserted at right angle to skin and elicit the motor response of foot and ankle joint at 0.5mA. The drug was injected slowly after frequent negative aspiration for blood.

Fig. 2: Labat' approach for sciatic nerve block

3.1. Method of subarachnoid block

Subarachnoid block was given in L3-L4 space with 23G spinal needle in lateral decubitus position on operated limb should be lower side. After confirming CSF injection bupivacaine heavy (0.5%) 2cc was given and patient was kept in same position for 10 min then kept supine position for unilateral subarachnoid block.

3.2. Assessment

After injecting drug onset, peak effect and duration of sensory and motor block were measured.

3.3. Sensory block

Aensory block level was assesed using pinprick method and assessed using 3-point scale:- 0 – Normal Sensation, 1 – Loss of pin prick sensation by using 24g needle, 2 - Loss of sensation.

3.4. Motor block

Motor block was evaluated with modified bromage scale:- Grade 0 = The Patient is able to move his hip knee and ankle joint, Grade 1 = the patient is unable to move hip but is able to move knee and ankle, Grade 2 = the patient is unable to move hip and knee but is able to move ankle, Grade 3 = the patient is unable to move hip, knee and ankle.

3.5. Vital parameters

Pulse-rate, spo2, blood pressure and ECG were continuously monitored using multipara monitor at immediately after block, 2 min, 5 min, every 10min there after till 1 hr and then every 20 min after till 2 hrs.

3.6. Complications

Following complications were anticipated in both the groups and treated accordingly.

Bradycardia: Heart rate < 60/min, was treated with inj. Atropine 0.6mg IV.

Hypotension: Fall in systolic blood pressure of more than 20% from pre-operative value. It was managed with IV fluids, vasopressors.

Arrhythmias: specific antiarrhythmic drugs were given.

Respiratory depression: Fall in SpO2 less than 94%. Managed with oxygen supplementation with NRBM (non rebreather mask) or Ventimask.

Systemic Local anaesthetic toxicity due to inadvertent intravascular injection.

Convulsions: To be treated by anticonvulsant drugs, 100% O2 and intubation if required.

Unintended injection of local anaesthetic into the subarachnoid space, epidural space, or vertebral artery in group P.

Allergic reaction or rarely anaphylaxis.

Infection antibiotics.

Observed in any groups were noted. The duration of first rescue analgesics were noted in both the groups post-operatively assessing VAS score.

Statistical analysis of the data was done using 't' test for all continuous variables and chi-square test for categorical (nonparametric) data using MedCalc software. The significance of statistical analysis was done by p value. P value <0.05 considered significant. P value > 0.05 was considered as not significant. P value < 0.001 considered as highly significant.

4. Results

96 patients were selected for study and divided into two groups P and S. in group P (n=48) there were 75% male and 25% female while in group S 66.66% male and 33.33% female. Mean age group in group P was 39.93± 10.55 and in group S 38.39±9.88.

All patients were in ASA I II III. ASA IV and V were not included in this study. The surgery carried out in both the groups were tibia interlock nailing, proximal tibia platting, distal tibia platting, raft plat, TENS, enders nailing. Both the groups were comparable with regard to demographic data (age, sex, physical status).

The onset of motor and sensory block was faster in group S compared to group P which was statistically significant. The duration of sensory and motor blockage was

significantly prolonged in group P as compared to group S. The efficacy of sensory and motor blockade was comparable in the groups and was statistically significant. Patients' lakes of complete motor and sensory were excluded from the study. The results of sensory and motor blockade were described in Table 1.

Variation of pulse rate and blood pressure were depicted as below

Pulse Rate (PR/Minute) and sp02

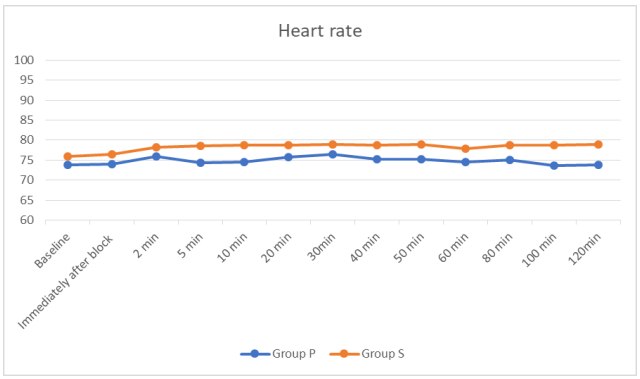

Fig. 3: Pulse rate

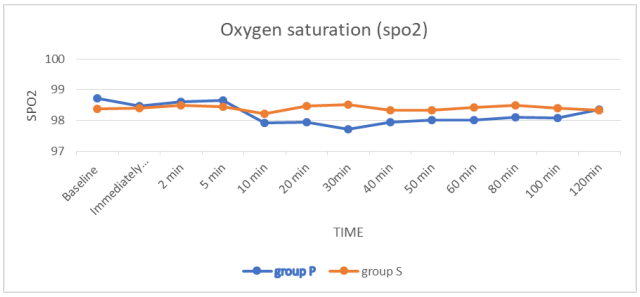

Fig. 4: SPO2

We found no significant changes in pulse rate and spo2 in both the groups.

Systolic and Diastolic Blood Ressure (mm Hg)

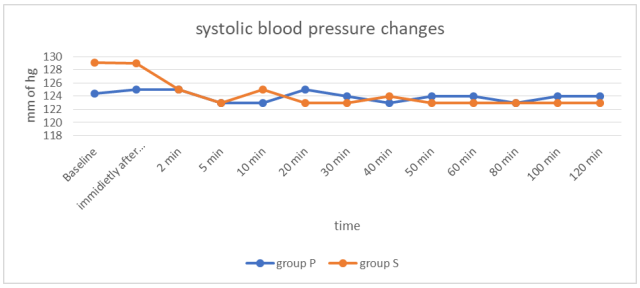

Fig. 5: Systolic blood pressure

We found that there was minimal fall in systolic and diastolic blood pressure in group S than in group P

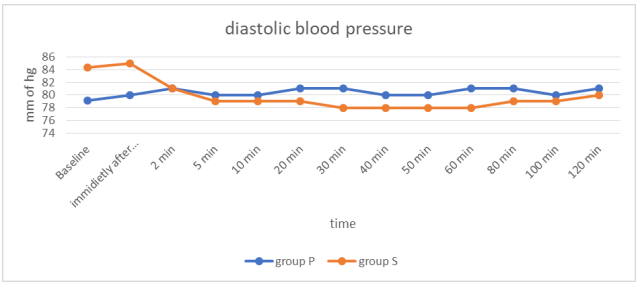

Fig. 6: Diastolic blood pressure

immediately after block as compare to baseline but this was within physiological limits. These indicates that incidence of hypotension is there in group S.

Post operative assessment was done by means of duration of sensory and motor blockade and analgesia and time for first rescue analgesic requirement.

Table 2 shows there were significant difference for rescue analgesic requirement. The duration of first rescue analgesic was 16.79 ± 1.23 hrs in group P than in group S which was 5.57±0.49 hrs which was highly significant

5. Discussion

Delivering anaesthesia to high-risk patients who have cardiovascular compromise can be challenging. Haemodynamic stability with good muscle relaxation with minimal airway manipulation with postoperative analgesia is goal for any anaesthetic technique. The decision is largely dichotomous with either a general anaesthetic (GA) and/or a regional technique which commonly includes a subarachnoid block (SAB) or a peripheral nerve block for any lower extremity surgery. Intraoperative stable vitals with less blood loss may reduce morbidity and mortality in high-risk patients.

Hence, the aim of analgesic protocols should be to reduce pain intensity and also decrease the incidence of side effects from analgesic agents. Moreover, adequate pain control is a pre-requisite for patient rehabilitation to accelerate functional recovery along with economic benefits to patient, hospital and society. The commonly used modalities for providing peri-operative analgesia includes systemic analgesic or regional block. Regional anaesthesia, especially peripheral nerve blocks have various advantages like

1. Decreased need for postoperative analgesics.
2. Decreased incidence of nausea and vomiting.
3. Shortened recovery time and hospital stay.
4. Early ambulation and discharge.

In this study we compare intra-operative anaesthetic parameter, hemodynamic stability and post-operative analgesia of two different regional anaesthesia methods

Table 1: Onset and peak effect of sensory and motor block

		Group P	Group S	P Value
Sensory	Onset (min)	11.77 ± 1.41	2.5 ± 0.58	<0.001 (Highly significant)
	Peak effect (min)	21.35 ± 2.12	4.83±0.72	<0.001 (Highly significant)
Motor block	Onset (min)	14.06 ± 2.12	1.79 ± 0.62	<0.001 (Highly significant)
	Peak effect (min)	19 ± 1.41	4.20 ± 0.94	<0.001 (Highly significant)

Table 2: Postoperative evaluation

		Group P	Group S	P value
Duration	Sensory (hour)	9.45 ±0.89	4.20±0.41	<0.001 (Highly significant)
	Motor (hour)	6.25 ±0.66	3.47±0.50	<0.001 (Highly significant)
	Analgesia (hour)	16.79 ± 1.23	5.57±0.49	<0.001 (Highly significant)
Number of rescue analgesic required		1.10 ± 0.30	3.04±0.20	<0.001 (Highly significant)

(Subarachnoid block and combined psoas plus sciatic nerve block). Although spinal anaesthesia (subarachnoid block) is most commonly used technique and considered as a gold standard for lower limb orthopaedic surgeries, it may lead to major haemodynamic changes and fluid shifts, because of sympathetic block. Combined psoas compartment block plus sciatic nerve block is associated with less sympathetic involvement and the somatic dominant effect. So gives better haemodynamic stability.

In this present study, demographic data of all the patients (age, sex and ASA grade) were comparable and have no significant influence on this study. All the patients were operated for tibial surgery. On evaluating sensory block by pin-prick method it was faster in group S then in group P. same as evaluation of motor block by MODIFIED BROMAGE SCALE it was faster in group S then group P. Both the block onset was statistically significant.

Duration of sensory and motor block were prolonged in group P than group S which was statistically significant with the studies like Sumana Kundu et al,[12] Jankowski,[13] Prerana Jogdand.[14] The number of rescue analgesic required post operatively was less in group P than in group S which also suggest prolong duration of analgesia.

There was no significant difference in haemodynamic parameters in both the groups by means of pulse rate and spo2. But systolic and diastolic blood pressure was decreased significantly in group S than in group P but it was also within physiological limits because lower dose of bupivacaine heavy with unilateral blockage. There was no any significant complication in both the groups. Only nausea observed in 2% patients in group S.

6. Conclusion

Combined psoas compartment block and sciatic nerve block gives prolong duration of analgesia with better haemodynamic stability intraoperatively. So, it is also an anaesthesia of choice in patient with heart disease, comorbidities, elderly, vertebral fracture, head injury.

7. Source of Funding

Nil.

8. Conflicts of Interest

There are no conflicts of interest.

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Author biography

Ankita Patel, Senior Resident https://orcid.org/0000-0001-7464-2557

Kavita Lalchandani, Associate Professor https://orcid.org/0000-0002-2902-4191

Heli Mehta, Senior Resident

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