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Combined Psoas Compartment Block and Sciatic Nerve Block for Elective Lower Limb Surgeries

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Abstract

Introduction: Lower limb orthopedic interventions such as total hip arthroplasty (THA) and total knee arthroplasty (TKA) present a challenge to the anesthetist, as these procedures typically involve elderly patients often suffering from multiple co-morbid conditions. In addition, these procedures generate significant postoperative pain. The psoas compartment block (PCB) is an alternative approach which may circumvent many of the side-effects associated with central neuraxial blockade. Combined with a sciatic nerve block, unilateral anesthesia of the lower limb may be induced ('Psoas compartment sciatic nerve block or PCSNB'). *Aim and Objective of the Study:* This study aimed at evaluation of the analgesic effect of combined psoas compartment block and sciatic nerve block in elective lower limb surgeries intra and post operatively. *Primary Objective:* To assess the effectiveness of the lower limb block based on 1) Sensory block 2) Motor block. *Secondary Objective*: time to request rescue analgesic. *Material and Method: Design of the Study*: Randomized controlled trial. *Selection of Subjects:* • Study involves adult patients of age 18 to 60 years of ASAps I - II posted for elective lower limb surgeries. • Sample size 60 •Randomization – computer generated random numbers • Monitors – NIBP, ECG and SpO_2 • Anaesthesia: Combined psoas compartment block and sciatic nerve block. Sixty patients were subjected to psoas compartment block and sciatic nerve block using nerve stimulator 30 ml of 0.25% of bupivacaine for psoas compartment block + and 20 ml 0.25% of bupivacaine for sciatic nerve block. Under strict aseptic precautions, psoas compartment block performed by posterior approach and and sciatic nerve block by labat's approach using peripheral nerve stimulator after obtaining twitch of quadriceps and calf muscle contraction and dorsiflexion of foot. • Assessment: Time of onset of analgesia and motor blockade, sensory blockade, total duration of analgesia and the time taken for 1st dose of rescue analgesia noted. *Results:* Sensory blockade by visual analogue scale reveals no pain upto 8 hours and almost complete block upto upto 6 hours in 73.3% of patients and good analgesic effect upto 9 to 10 hours in 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients) Motor blockade assessed by modified bromage scale at 2 hours revealed a score of 1 (complete block – unable to move feet or knee) in 60 out of 60 patients (100%), at 6 hours revealed a score of 2 (almost complete block – unable to move feet only) in 44 out of 60 patients (73.3%) and 3 (partial block – able to move knees) in 16 out of 60 patients (26.7%) and at 8 hours revealed a score of 3 (partial block – able to move knees) in 29 out of 60 patients (48.3%) and 4 (detectable weakness of hip flexion while supine, full flexion of knees) in 31 out of 60 patients (51.7%). The incidence of first dose of rescue analgesia (inj.Tramadol 50 mg iv) at 9 to 10 hours in 48.3%(29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients). Mean Total rescue analgesic dosage was 120 mg of inj.Tramadol and mean number of doses required was 2.2. One patient got seizure following the block and one patient developed hematoma at the injection site postoperatively both treated conservatively. Five patients had nausea and vomiting treated with inj.ondensetron 0.15 mg/kg i.v. *Conclusion:* This study concluded that skillful application of psoas compartment bock by posterior approach and proximal sciatic nerve block provides adequate intraoperative analgesia for major lower extremity procedures

Keywords: Psoas Compartment Block; Sciatic Nerve Block; Nerve Stimulator; Bupivaccine..

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Introduction

Lower limb orthopedic interventions such as total hip arthroplasty (THA) and total knee arthroplasty (TKA) present a challenge to the anesthetist, as these procedures typically involve elderly patients often suffering from multiple co-morbid conditions. In addition, these procedures generate significant postoperative pain. Anesthetic management usually involves the use of central neuraxial blocks or general anesthesia (GA), with systemic analgesics administered for pain after surgery. The psoas compartment block (PCB) is an alternative approach which may circumvent many of the side-effects associated with these techniques. Combined with a sciatic nerve block, unilateral anesthesia of the lower limb may be induced.

Aim and Objective of the Study

This study was aimed at evaluation of the motor and sensory blockade and post operative analgesia using combined psoas compartment block and sciatic nerve block in elective lower limb surgeries.

Primary Objective

To assess the effectiveness of the lower limb block based on

1) Sensory block

2) Motor block

3) Post operative analgesia

Secondary Objective

To assess the onset of block, total duration of Block, and the time taken for the first dose of rescue analgesia and to look for complications if any.

Materials and Methods

Design of the Study

- Randomized Prospective study

Selection of Subjects

- Study involves adult patients of age 18 to 60 years of ASAps I- II posted for elective lower limb surgeries.
- Sample size 60.
- Randomization – computer generated random numbers.
- Monitors – NIBP, ECG and SpO_2.

Anaesthesia

Combined Psoas Compartment Block and Sciatic Nerve Block.

Sixty patients were subjected to psoas compartment block followed by sciatic nerve block using nerve stimulator. Thirty ml of 0.25% of bupivacaine for psoas compartment block and 20 ml 0.25% of bupivacaine for sciatic nerve block WAS administered. Under strict aseptic precautions, psoas compartment block performed by posterior approach and sciatic nerve block by labat's approach using peripheral nerve stimulator after obtaining twitch of quadriceps and calf muscle contraction and dorsiflexion of foot.

Supplemental oxygen provided during and after the procedure.

- Assessment: Time of onset of analgesia and motor blockade, sensory blockade, total duration of analgesia and the time taken for 1st dose of rescue analgesia noted.

Exclusion Criteria

- Neurological disorder
- Age < 18 years
- ASA class > II
- Infection at the puncture site
- Patients refusal
- Patients with hypersensitivity to bupivacaine
- Coagulation disorder
- Antenatal cases

Methods

Patient was connected to monitors. Baseline vitals obtained. Intravenous line secured. Under strict aseptic precautions, psoas compartment block performed by posterior approach followed by sciatic nerve block by labat's approach using peripheral nervestimulator after obtaining twitch of quadriceps and calf muscle contraction and dorsiflexion of foot. Supplemental oxygen provided during and after the procedure.

Following Parameters Were Noted

- Time of onset of sensory blockade

- Time taken for onset of motor blockade:
- From the time of BLOCK, visual analogue scale noted for every 30 minutes 1 hour, 2 hour by 4, 6, and 8 hours
- From the time of block Bromage score noted for 2, 6, and 8 hours
- Time elapsed till first rescue analgesia dose
- Other side effects:

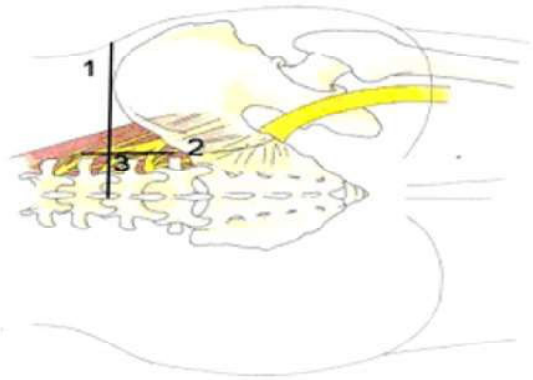
Posterior Approach [Winnies] was used for Lumbar Plexus Block and Labats Approach for Sciatic Nerve Block

Patient Position

There are several posterior landmark based approaches to the lumbar plexus all of which require the patient to be in the lateral position with the operative side uppermost, the hips and knees are flexed to 90 degrees;

Landmarks of the lumbar plexus.

1. Tuffiers line
2. Posterior Superior Iliac spine
3. Lumbar plexus

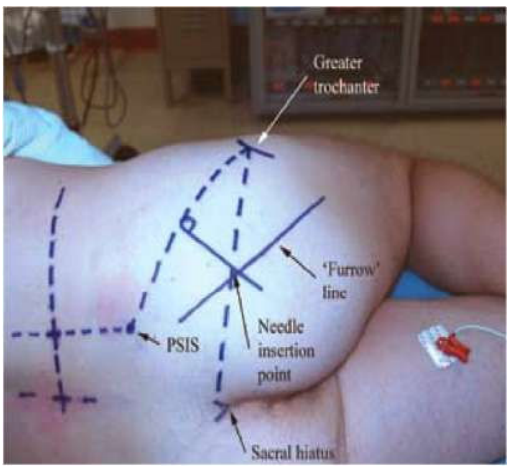


Winnie's Approach,

An intercristal line is drawn at L4/L5, and another parallel with thespine through the Posterior Superior Iliac Spine (PSIS). The needle is inserted at the intersection of these lines with a slight medial inclination. The needle should be between the transverse processes of L4 and L5. The needle can be redirected caudally if the transverse process of L5 is encountered. The accepted end point for the lumbar plexus is stimulation of the femoral nerve, observed by contraction of the quadriceps muscle. Quadriceps contraction which produces patella twitching should be sought with an initial current of 1-2 mA, and once elicited the current should be reduced until contraction is still present at <0.5 mA. (If muscle contraction is lost before 0.5 mA then gentle needle repositioning is required). Contraction should stop below a current of 0.2 mA, otherwise intraneural needle position should be suspected

Labats Approach of Sciatic Nerve

In Labat's classic approach, the patient is placed in lateral decubitus position (operative side, up), and the leg is flexed at the knee. If the patient is unable to flex the leg, the leg should be extended at the hip as far as possible without producing patient discomfort. Draw a line between the greater trochanter to the posterior superior iliac spine (PSIS). Draw a second line from the greater trochanter to the patient's sacral hiatus (Winnie's modification). Determine the point of initial needle insertion by drawing a line perpendicular from the midpoint of the first line to its intersection with the secondline. A fourth line can be drawn along the "furrow" formed by the medial edge of the gluteus maximus muscle and the long head of the biceps femoris muscle. The furrow represents the course of the sciatic nerve toward the lower leg. The triangle formed by the first, second, and fourth lines further defines initial needle placement, and subsequent adjustments of the needle within the triangle can improve success at sciatic nerve stimulation. Successful needle placement in proximity to the sciatic nerve is observed with plantar flexion/ inversion (tibial nerve) or dorsiflexion/eversion (common peroneal nerve) with 0.5 mA or less of current. Successful needle placement in proximity to the sciatic nerve is observed with plantar flexion/ inversion (tibial nerve) or dorsiflexion/eversion (common peroneal nerve) with 0.5 mA or less of current.



Sensory blockade assessed by visual analogue scale and motor blockade using Modified bromage scale.

Statistical Analysis

Data was analyzed using descriptive statistics. Percentage of occurrence was calculated for observed parameters.

Table 1:

Age	Frequency	Percent
<30 yrs	22	36.67
31-40	10	16.67
41-50	6	10.00
51-60	22	36.67
Total	60	100.00
Sex	**Frequency**	**Percent**
Male	45	75
Female	15	25
Total	60	100
Weight in kgs	**Frequency**	**Percent**
50-70 kgs	56	93.3%
70-90 kgs	4	6.7%
Total	60	100
ASA	**Frequency**	**Percent**
I	26	43.3
II	34	56.7
Total	60	100

Table 2: Onset of Sensory and Motor Blockade Sensory blockade

Mean onset time of sensory blockade	18.22 min
Mean onset time of motor blockade	20.2 min

Table 3: Sensory Blockade by Visual Analogue Scale at Various Time Intervals

VAS	30 mins	1 hr	2 hr	4 hr	6 hr	8 hr
I	59 (98.3%)	58 (96.7%)	56 (93.3%)	58 (96.7%)	18 (30%)	0
II	1 (1.7%)	2 (3.3%)	4 (6.7%)	2 (3.3%)	33 (55%)	26 (43.3%)
III	0	0	0	0	9 (15%)	34 (56.7%)

Table 4:

BS	2 hr	6 hr	8 hr
I	60		
II		44(73.3%)	
III		16(26.7%)	29(48.3%)
IV			31(51.7%)

Table 5: IST Dose Of Rescue Analgesia

Rescue Analgesia	Frequency	Percent
9 to 10 Hr	29	48.3
10 to 11 Hr	31	51.7
Mean Total recue analgesic dose	120 mg (Tramadol 50 mg as intravenous analgesic)	
Mean Total number of boluses of resue analgesic required	2.2	

The incidence of first dose of rescue analgesia at 9 to 10 hours is 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients).

Table 6: Complications

Accidental Intravascular injection	1(1.7%)
Hematoma formation	1(1.7%)
Nausea and vomiting	5(%)

Results

All the sixty patients' age, sex, weight and ASA was noted.

Sensory blockade assessed by visual analogue scale at thirty minutes revealed a score of 1(no pain) for 59 out of 60 patients (98.3%) and 2 (no pain) for 1 out of 60 patients (1.7%), at one hour revealed a score of 1 (no pain) for 58 out of 60 patients (96.7%) and a score of 2 (no pain) for 2 out of 60 patients (3.3%), at two hours revealed a score of 1(no pain) for 56 out of 60 patients (93.3%) and a score of 2

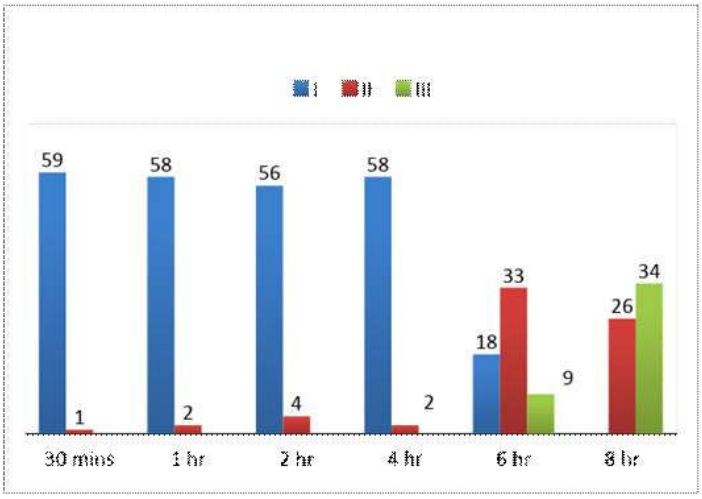


Fig 1: Onset of Sensory and Motor Blockade Sensory blockade

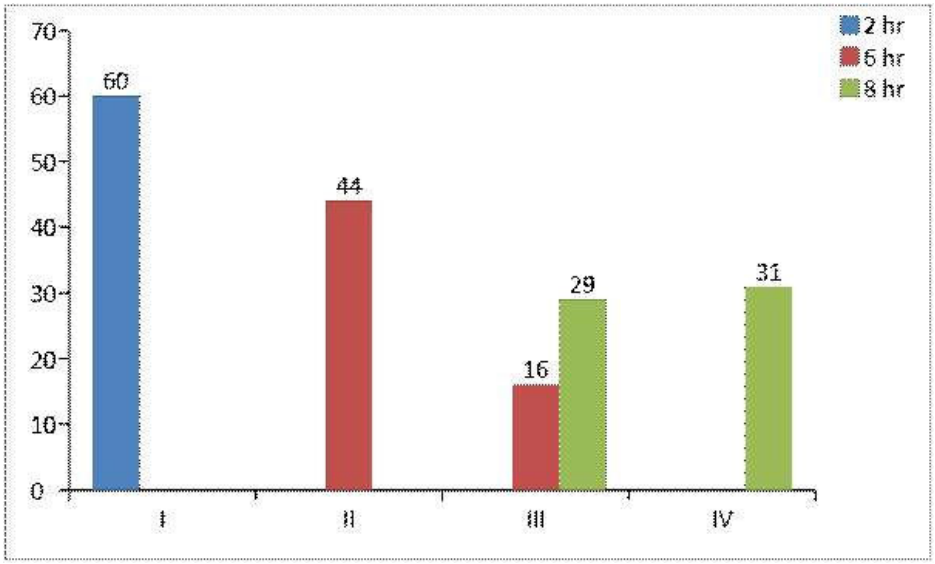


Fig 2: Motor Blockade by Modified Bromage Scale at Various Time Intervals

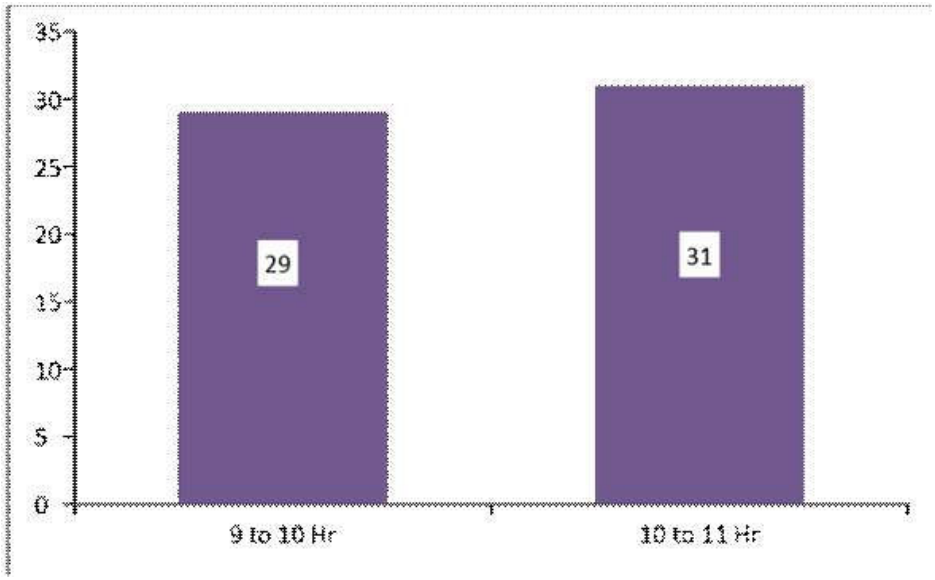


Fig 3: IST Dose of Rescue Analgesia

(no pain) for 4 out of 60 patients (6.7%), at four hours revealed a score of 1 (no pain) for 52 out of 60 patients (86.7%) and a score of 2 (no pain) for 8 out of 60 patients (13.3%), at six hours revealed a score of 1 for 18 out of 60 patients (30%), a score of 2 for 33 out of 60 patients (55%) and a score of 3 for 9 out of 60 patients (15%) and at eight hours revealed a score of 2 for 26 out of 60 patients (43.3%) and a score of 3 for 34 out of 60 patients (56.7%).

Motor blockade assessed by modified bromage scale at 2 hours revealed a score of 1(complete block – unable to move feet or knee) in 60 out of 60 patients (100%), at 6 hours revealed a score of 2 (almost complete block – unable to move feet only) in 44 out of 60 patients (73.3%) and 3 (partial block – able to move knees) in 16 out of 60 patients (26.7%) and at 8 hours revealed a score of 3 (partial block – able to move knees) in 29 out of 60 patients (48.3%) and 4 (detectable weakness of hip flexion while supine, full flexion of knees) in 31 out of 60 patients (51.7%).

The incidence of first dose of rescue analgesia (inj. Tramadol 50 mg iv) at 9 to 10 hours in 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients). Mean Total rescue analgesic dosage was 120 mg of inj.Tramadol and mean number of doses required was 2.2.

One patient got seizure following the block and one patient developed hematoma at the injection

site postoperatively both treated conservatively. Five patients had nausea and vomiting treated with inj.ondensetron 0.15 mg/kg i.v.

Discussion

Several studies have evaluated the psoas block and sciatic nerve block in patients undergoing major orthopedic hip surgery [1] or knee procedures [2]. The study included the sciatic nerve blockade with psoas compartment block rather than either technique alone, as regional techniques because of the more reliable blockade of the complete lumbosacral plexus [3].

This study was conducted on sixty patients who underwent orthopedic surgical procedures including; total knee arthroplasty or revision, femoral plate and screws, knee arthroscopies, corrective osteotomies of lower limb, tibial fractures, ankle surgeries and others.

The patients were subjected to psoas compartment block (posterior approach) combined with proximal sciatic block (labat's approach). The anesthetic effects and other measurements were meticulously evaluated intra and postoperatively.

The results of this study agrees with what was observed by Montes and colleagues, in their comparative study of spinal anesthesia with combined sciatic-femoral block done on 50 patients undergoing knee arthroscopy, as they found that combined sciatic-femoral nerve blocks were associated with significantly lower pain scores during the first 6 postoperative hours ($p<0.002$) [4].

As reported by Aim and colleagues in their study comparing sciatic – psoas compartment block and sciatic-femoral 3-in-1 block for knee arthroscopy, hemodynamic parameters did not significantly differ between groups [5]. In previous reports, decreased heart rate was observed in patients undergoing psoas compartment block. This change was explained by a possible neuroaxial spread of the psoas compartment block due to the injection of large volumes of local anesthetic agent.

Another study by Auroy and colleagues reported about 1% incidence of psoas compartment block complications due to epidural and intrathecal spread of local anesthetic [6]. However, we observed no signs or symptoms of epidural involvement in our patients, a finding that may explain the lack of difference in hemodynamic changes between the studied groups which could be attributed mostly to the fixed average volume and low concentration of local anesthetic injected (30 ml of bupivacaine 0.25%). Another complication of the psoas compartment block may be direct nerve injury due to the needle [7].

The results of this study showed that the need for postoperative opioid analgesia in the form of Tramadol 50 mg i.v doses was much less in the combined psoas-sciatic group. Besides, the time by which they required first opioid dose was much delayed. This finding agreed with a study conducted by Moreno and Cassalia on lumbar plexus anesthesia, which reported an excellent and prolonged postoperative analgesia (more than 18 hours), which significantly decreases the need of opioids during this period [8].

Boouaziz and colleagues reported that the use of psoas blocks for analgesia after knee arthroplasty has been advocated because femoral analgesia blocks the obturator nerve to an insufficient degree [9]. However, even though psoas blocks cover the obturator nerve better, both Kaloul et al. and Morin et al. found no significant difference in pain scores during physiotherapy [10].

In our study, dynamic pain levels assessed by visual analogue scale (VAS) were low (psoas-sciatic block). In the study reported by Kaloul, the sciatic nerve was not blocked. It is because the pain arising from the sciatic nerve may be relevant after knee arthroplasty [11], that this combination may be necessary.

In the study by Morin and colleagues the combined femoral and colleagues, the combined femoral and sciatic catheter group had fixed infusion rates of 14 mg/hr. Accordingly, opioid consumption over 24 hours was much higher in the study by Morin and colleagues than in our almost opioid free patients in both studied groups.

In a study by Frassanito and colleagues in 2008 conducted on 40 patients on "The efficacy of the psoas compartment block versus the intrathecal combination of morphine, fentanyl and bupivacaine for postoperative analgesia after primary hip arthroplasty", it was found that despite the absolute VAS was higher in psoas compartment block [PCB] group than in intrathecal fentanyl-morphine [IFM] group, no statistically significant difference between the two groups was observed which partially opposes the results of our study [12]. In the same study by Frassanito and colleagues, tramadol consumption was lower in the IFM group than in the PCB group: 30 ± 70 mg vs. 210 ± 400 mg during the first 12 hours, 180 ± 120 mg vs. 320 ± 100 mg during the first 24 hours. This doesn't agree with the results of our study regarding 24 hr postoperative pethidine consumption which revealed being lower [combined psoas-sciatic] the incidence of first dose

of rescue analgesia at 9 to 10 hours is 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients).

However, in the Frassanito study the above results were statistically non-significant.

Moreno and Cassalia reported in their study "lumbar plexus anesthesia: Psoas compartment block" in 2006 that specific blockade of only one extremity avoids side effects of central neuroaxial blockades like spinal anesthesia (such as bilateral sympathetic blockade). This allows quick recovery, ambulation, and physiotherapy, which perfectly supports the results of the current study.

Raimer and colleagues, in their prospective study [continuous psoas and sciatic block after knee arthroplasty: good effects compared to epidural analgesia or i.v opioid analgesia], reported that pain therapy after total knee arthroplasty either by epidural or continuous psoas-sciatic blocks was better than by intravenous opioid patient controlled analgesia. This result is in line with earlier reports showing that adequate analgesia after total knee arthroplasty cannot be achieved with intravenous patient controlled analgesia alone [13].

- Patient's acceptance of regional techniques depends on different factors, such as the number of nerve stimulations, intensity of stimulation, electrical paresthesia, repeated needle insertions, infiltration of needle insertions, and infiltration of needle puncture site with local anesthetics, muscle contractions, bony contacts and associated sedation [14].

Pain and/or discomfort may lead to patient's dissatisfaction or rejection of the technique for further operations beyond effective analgesia. Pain due to the regional technique was higher in the psoas compartment and in sciatic nerve blocks compared to spinal analgesia, probably because performance of these nerve blocks is associated with uncomfortable electrical sensations.

In our study, satisfaction scores expressed mainly as VAS. However, satisfaction with regional analgesia is a complex phenomenon that cannot be assessed well by a single global measurement, such as a VAS, which generally results in high satisfaction rating.

Lastly, this was implicated upon the surgeons who had the impression that their patients are more likely to have positive psycho-emotional response toward their experience, and begin the process of coping with their recovery and rehabilitation programs because of the comfortable postoperative period provided by the long lasting lumbar plexus together with sciatic nerve blocks analgesia Sensory blockade by visual analogue scale reveals no pain upto 8 hours and almost complete block upto upto 6 hours in 73.3% of patients and good analgesic effect upto 9 to 10 hours in 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients).

Motor blockade assessed by modified bromage scale at 2 hours revealed complete block in all 60 patients (100%).

Motor blockade assessed by modified bromage scale at 6 hours revealed a score of 2 (almost complete block – unable to move feet only) in 44 out of 60 patients (73.3%) and 3 (partial block – able to move knees) in 16 out of 60 patients (26.7%).

Motor blockade assessed by modified bromage scale at 8 hours revealed a score of 3 (partial block – able to move knees) in 29 out of 60 patients (48.3%) and 4 (detectable weakness of hip flexion while supine, full flexion of knees) in 31 out of 60 patients (51.7%).

The incidence of first dose of rescue analgesia at 9 to 10 hours is 48.3% (29 out of 60 patients) and at 10 to 11 hours is 51.7% (31 out of 60 patients).

So overall it provides effective sensory and motor blockade and good Postop analgesic effect.

Conclusion

This study concluded that skillful application of psoas compartment block by posterior approach [Winnies Approach] and proximal sciatic nerve block [Labats Approach] provides adequate intraoperative analgesia for major lower extremity procedures and maintains prolonged postoperative analgesia.

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