

Study on evaluating the Adequacy of Psoas Compartment Block and Sacral Plexus Block for Lower Limb Surgeries

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ABSTRACT

Background: To evaluate the adequacy of combined psoas and sacral plexus block (SPB) as a sole anesthetic agent, patients'/surgeons' satisfaction, perioperative urinary retention, and duration of postoperative analgesia for unilateral lower limb surgeries.

Materials and methods: A single-center prospective study was conducted between March and August 2016 on 101 patients undergoing elective unilateral lower limb surgeries under combined psoas and SPB belonging to American Society of Anesthesiologists physical status 1 and 2, aged between 18 and 60 years. Adequacy of block, patients'/surgeons' satisfaction, perioperative urinary retention, and duration of postoperative analgesia were noted.

Results: Among the 101 patients, 1 patient was excluded from the study. In 93 patients (93%), the block was adequate. Among the patients with adequate block, the surgeons' and patients' satisfaction was 95.7 and 96.8% respectively. Eight patients were catheterized preoperatively and rest of the 92 patients (100%) voided spontaneously without any intervention. The average time of first analgesic dose was 347.7 ± 103.7 min.

Conclusion: Combined psoas and SPB is a good and a safe alternative to neuraxial block in patients undergoing unilateral lower limb surgeries with good surgeon and patient satisfaction, lesser incidence of urinary retention, and prolonged postoperative pain relief.

Keywords: Postoperative urinary retention, Psoas compartment block, Sacral plexus block.

How to cite this article: Vinod K, Kuhrekar P, Sharanya K, Raghuraman MS. Study on evaluating the Adequacy of Psoas Compartment Block and Sacral Plexus Block for Lower Limb Surgeries. *J Recent Adv Pain* 2017;3(2):66-70.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Patients undergo lower limb surgeries for a variety of conditions ranging from fractures, arthroscopies,

vascular procedures to diabetic foot debridement and amputation. Anesthetizing these patients can be quiet challenging because of the comorbid general conditions including old age, concomitant anticoagulant administration, and complications of diabetic autonomic neuropathy. General anesthesia, when administered to these groups of patients, has higher incidence of postoperative cognitive dysfunction,¹ pulmonary complications, postoperative nausea/vomiting, and delay in recovery. Regional anesthesia including central neuraxial blocks and peripheral plexus blocks has been validated by systemic review studies to be beneficial in reducing the mortality and morbidity by reducing the incidence of venous thromboembolic complications, pneumonia, and transfusion requirement.²⁻⁴ Among the regional blocks, subarachnoid block is the most commonly performed procedure, but is associated with complications like intraoperative hypotension which may be difficult to handle in a patient with diabetic autonomic neuropathy or dilated cardiomyopathy, postdural puncture headache preventing early mobilization, urinary retention requiring catheterization, and epidural hematoma.⁵ Peripheral plexus block can provide an alternate to the above-mentioned techniques as they are associated with stable hemodynamics, less complications, and early recovery.

Psoas compartment block (PCB) blocks femoral nerve, obturator nerve, and lateral cutaneous nerve of the thigh. Sacral plexus block (SPB) blocks sciatic nerve and posterior cutaneous nerve of the thigh. When PCB and SPB are combined together, complete lower limb anesthesia is obtained.⁶ Limited number of articles were published⁷⁻¹⁰ in the past on PCB and SPB, mostly case reports, retrospective study, or studies with smaller sample size, hence, we felt that our study could throw more light into this subject.

Primary aim of the study was to check adequacy of block as assessed by complete sensory and motor blockade by the end of 40 minutes after giving the block. Secondary aim of study was to assess patients' satisfaction, surgeons' satisfaction, postoperative urinary retention, and duration of analgesia.

MATERIALS AND METHODS

Our study was a single-center prospective single-blinded study with prior approval from the institutional ethical

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committee. The study was done over a period of 6 months (March–August 2016). After obtaining written informed consent, 101 patients belonging to American Society of Anesthesiologists physical status I and II, between 18 and 60 years of age, undergoing unilateral lower limb surgeries, were included in the study. Patients with coagulopathy, neuropathy, psychiatric illness, and emergency surgeries were excluded from the study.

All patients were on nil per oral for 6 hours prior to surgery. Intravenous access was obtained with an 18G cannula. Monitoring of electrocardiogram, saturation of oxygen (SpO₂), and noninvasive blood pressure were done. Every patient was premedicated with glycopyrrolate 0.2 mg intravenously (IV), fentanyl 2 µg/kg IV, and dexmedetomidine 0.5 µg/kg IV over a period of 15 minutes followed by 0.5 µg/kg/hour as infusion throughout the duration of surgery. Patients were positioned laterally with the side to be blocked as the nondependent side for performing the blocks. Each block was administered by the same anesthesiologist to avoid inter-administrator variability, and the study variables were assessed by another anesthesiologist. Psoas compartment block was performed by Capdevilla's approach.¹¹ A line connecting the highest point of the iliac crest on both sides was drawn (intercristal line, corresponding to L4 spine). Two parallel horizontal lines were drawn passing through spinous process and posterior superior iliac spine (PSIS), intersecting the intercristal line. Needle insertion site was the junction of lateral third and medial two-thirds of the line between spinous process of L4 and the line passing through PSIS. The needle was advanced (nerve locator needle 15 cm Stimuplex needle, current 1.5 mA, 2 Hz) until it reaches the transverse process of L4 and then the needle was withdrawn and directed caudally until quadriceps contraction (desired response) was seen. The current is gradually reduced until the desired response is obtained with a current strength of 0.5 to 0.3 mA. Local anesthetic solution containing 20 mL of 0.25% bupivacaine was injected incrementally after repeated aspiration.

Sacral plexus block¹² was carried out by placing the patient in the same position as mentioned earlier. A line was drawn connecting PSIS and ischial tuberosity on the side to be blocked. Along the line, a mark is made at 6 cm inferior to PSIS, defining the needle insertion site. The nerve stimulator needle (15 cm, 1.5 mA, 2 Hz) is advanced in a sagittal plane until an evoked response is obtained (plantar or dorsiflexion, hamstring contraction) with a current of 0.3 to 0.5 mA. Twenty milliliters of 0.25% of Inj bupivacaine was injected incrementally after careful aspiration. Patients undergoing hip surgery were given infiltration over the iliac crest to block the subcostal nerve with 5 mL of 0.25% bupivacaine. The patients were

then positioned in supine position, and the onset of each nerve block was assessed once in every 5 minutes up to 40 minutes.

Sensory block was assessed using a 24G hypodermic needle. Absence of sensation to pin prick in the following areas was noted: (1) Sole of foot – sciatic nerve, (2) anterior thigh – femoral nerve, (3) lateral thigh – lateral cutaneous nerve of thigh, (4) medial thigh – obturator nerve, (5) posterior thigh – posterior cutaneous nerve of thigh. Motor block was assessed using Bromage score scale:¹³ 0 – no motor impairment (able to move hip, knee, and ankle joints); 1 – unable to raise the extended leg (able to move the ankle and knee joints); 2 – unable to raise the extended leg and flex the knee joint (able to move the ankle joint); 3 – unable to move the knee and foot.

Patients' and surgeons' satisfaction with the nerve block technique was evaluated using a two-point scale¹⁴: 1 – satisfactory (if required, I would have the same anesthetic agent again); 2 – unsatisfactory (I would prefer a different anesthetic). In the postoperative period, the patients' ability to void urine spontaneously or following catheterization was noted. Time to first analgesic dose was calculated from the time the patient was turned to supine position after the block to the first instance of complaint of pain by the patient. The patients were administered 2 mg/kg Tramadol intramuscularly for analgesia.

All data were assessed using IBM Statistical Package for Social Sciences version 23 (IBM Corporation, USA) for Windows (Microsoft Corporation, USA). Sample size calculation was done based on previous study with success rate of 92%. Sample size of 92 was needed for success rate of 100% with significance of 5% and study power of 80%. Hence, 101 patients were included in the study to allow dropouts. It is a descriptive analysis for calculating mean, standard deviation, frequency distribution, and percentage analysis.

RESULTS

A total of 101 patients undergoing unilateral lower limb surgeries were enrolled for the study. One patient became unresponsive after PCB but was resuscitated and the case was continued with general anesthesia. This patient was excluded from the study. The baseline characteristics of the patients are shown in Table 1. Out of the 100 patients, 68 were males and 32 were females. The mean age was 44.3 ± 13.3 years (18–60 years). Diabetes mellitus was the most common comorbid illness suffered by the patients (45 patients). The details of the procedure underwent by the patients are shown in Table 2, which shows fracture surgeries being the maximum. As shown in Graphs 1 to 3, the block was successful in 93 patients (93%) and was inadequate in 7 (7%) patients who were switched over to

Table 1: Demographics of the patients

Baseline characteristics	n
Age (years)	
• 18–30	18
• 31–45	31
• 46–60	51
Gender	
• Male	68
• Female	32
ASA physical status	
• 1	38
• 2	62
Comorbid conditions	
• Diabetes mellitus	45
• Hypertension	24
• Anemia	18
• Respiratory disease	04
• Thyroid disease	09
Type of procedure	
• Fracture surgeries	47
• Diabetic foot debridement and amputation	18
• Knee arthroscopies	16
• Split skin graft, varicose vein, and others	19

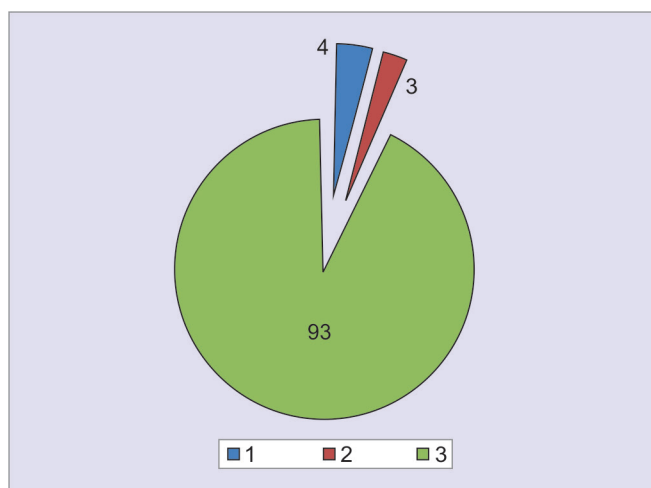
general anesthesia later. The 93 patients with adequate block had a Bromage scale of 3 and no sensory sparing. Among the patients with inadequate block, a Bromage scale score of 2 was seen in three patients (3%) and a score of 1 was seen in four patients (4%) (Fig. 1). Sensory sparing was seen in femoral nerve distribution in four patients (4%) and in sciatic nerve distribution in three patients (3%) (Fig. 2). Among the patients with adequate block, the surgeons were not satisfied with the motor block in four patients (4.3%) and three patients (3.2%) were not satisfied with the technique (Tables 2). Among the 100 patients, eight patients were catheterized preoperatively due to different indications, and the rest of the patients voided spontaneously without any intervention in the postoperative period. The average time of first analgesic dose was 347.7 ± 103.7 min.

Table 2: Surgeon and patient comfort

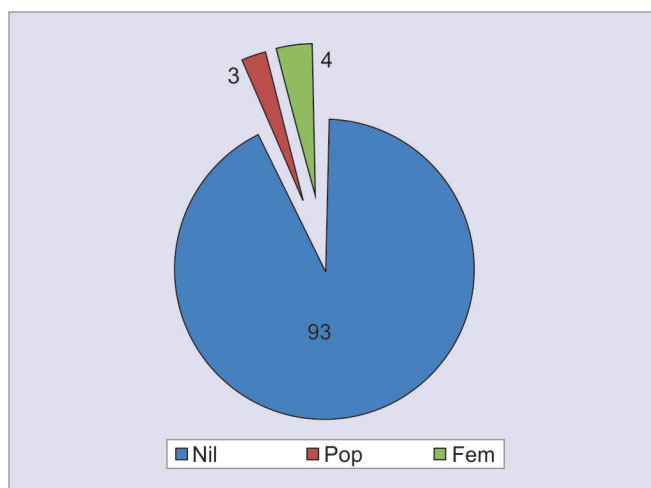
Surgeon–patient comfort	Frequency	Percent
Surgeon 1	89	95.7
Surgeon 2	04	4.3
Total	93	100
Patient 1	90	96.8
Patient 2	03	3.2
Total	93	100



Graph 1: Block adequacy – 1



Graph 2: Motor Blockade – 2



Graph 3: Sensory sparing – 3

DISCUSSION

This study shows that combining PCB and SPB can be an effective and safer alternative to general anesthesia and central neuraxial blocks, which are given for unilateral lower limb surgeries. Tourniquet was used in all patients except hip surgeries. The success rate of providing





Fig. 1: Landmarks for psoas compartment block



Fig. 2: Landmarks for sacral plexus block

surgical blockade of PCB in our study was comparable to other studies in the past. Chayen et al¹⁵ demonstrated a success rate of 90% with PCB performed at L4–L5 level. Farny et al¹⁶ demonstrated a success rate of 89% with PCB. Parkinson et al¹⁷ performed a study on PCB using Dekrey's approach at L3 and L4–L5 level, with success rate of 96% and 91% respectively.

In the study conducted by Horasanli et al¹⁴ with 35 patients who underwent PCB through Capdevilla's approach, the success rate was 92.5%, which was very close to that of our study. In a retrospective study conducted by Petchara et al,¹⁰ 70 patients underwent PCB, and adequate surgical anesthesia was achieved in all patients, with a success rate of 100%. In the study done by de Visme et al,⁷ the success rate was 100% in providing surgical anesthesia with a sample size of 15 patients.

Overall, patients' and surgeons' satisfaction in our study was 96.8% and 95.7% respectively. When compared with the study conducted by Horasanli et al¹⁴ (patients' and surgeons' satisfaction was 75.7% and 81% respectively), patients' and surgeons' satisfaction was comparatively high. The high satisfaction rate was probably because of dexmedetomidine-induced sedation and enhanced motor and sensory blockade. Dexmedetomidine, a highly specific centrally acting alfa-2 agonist, was used in our study for sedation, improving patient satisfaction and analgesia without causing respiratory depression.¹⁸⁻²⁰

In parasacral approach to sciatic nerve block, pudendal nerve would be blocked and there is a possibility of urinary retention. The incidence of urinary retention is <5%⁶ in the literature. In our study, when the patients catheterized preoperatively were excluded, all the patients voided urine spontaneously without any intervention.

Time of first analgesic dose observed in our study was 347.69 ± 103.75 minutes with 20 mL of 0.25% bupivacaine.

Horasanli et al¹⁴ had similar duration of analgesia with a median of 360 minutes. In the study done by Greengrass et al,²¹ the duration following PCB and sciatic nerve block with 0.5% bupivacaine was 17 ± 3 hours.

Our study has some limitations. Firstly, this is not a comparative study, hence, further studies are required to study the exact adequacy of nerve plexus block over neuraxial anesthesia in the same population. Secondly, the study group had cases with different diagnoses and varying duration of the procedure and was done by different surgeons, hence, the surgeons'/patients' satisfaction and time of first analgesic dose could not be reliably estimated. Recently, ultrasound guidance has been used in combination with nerve locator technique to increase the success and reduce the complications which has not been used in our study.

CONCLUSION

Thus, we conclude that combined psoas and SPB with intravenous dexmedetomidine can provide a formidable and safe alternative to neuraxial blocks in high-risk, long-standing diabetic and vascular surgery patients undergoing unilateral lower limb surgeries. It has a good success rate, adequate surgeon/patient satisfaction without complications like postdural puncture headache and urinary retention.

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