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Sacral plexus block for post-operative pain relief in below knee orthopaedic surgeries

Sujata Shelke, Sandeep Mutha, Deepak Phalgune
Poona Hospital & Research Centre, Pune, Maharashtra, India.

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***Corresponding author:**

Email : dphalgune@gmail.com
Phone : +91 9850434220

ABSTRACT

Sacral plexus nerve block provides post-operative pain relief after below knee surgery and knee surgery. Many studies with different approaches for sacral plexus nerve block have been conducted to demonstrate the efficacy of it. The findings are conflicting. Hence, an attempt was made in the present research to study the efficacy of peripheral nerve stimulator guided sacral plexus block for post-operative pain management in below knee orthopaedic surgery. Sixty patients aged 18 to 60 years scheduled for unilateral below knee orthopaedic surgery under spinal anaesthesia were included. Sacral plexus nerve block was given by posterior approach before spinal anaesthesia using 0.5 % bupivacaine. Pain was assessed using visual analogue scale (VAS) score. Diclofenac sodium 75 mg intra-venous was given slowly as rescue analgesia when VAS score was > 4. Time of supplemental analgesia was noted. Primary outcome measures were to study duration of sacral plexus block and the requirement of rescue analgesia whereas secondary outcome measures were to study the adverse effects of sacral plexus block. Single shot sacral plexus block provided effective pain relief up to 24 hours in below knee orthopedic surgery. It decreased analgesic drugs consumption significantly post-operatively. No adverse systemic toxicity was observed within 24 hours after the operation. Single shot sacral plexus nerve block provided effective pain relief to majority of the patients up to 24 hours in below knee orthopaedic surgery and decreased analgesic drugs requirement postoperatively. Sacral plexus nerve block is safe with no adverse effects

INTRODUCTION

Anaesthesia for lower limb surgeries is a challenge as most of the patients undergoing lower limb surgeries are elderly and may have multiple comorbid conditions such as cardiac, renal, cerebral, respiratory and endocrine diseases. All these comorbid conditions may adversely affect the outcome of the surgery and increase the peri-operative and post-operative morbidity.[1-2] Effective peri-operative management of anaesthesia and post-operative analgesia is important for the patient comfort and satisfaction, allows greater mobility, minimizes post-operative morbidity and mortality, and prevents/decreases muscle spasms.[3]

Fractures of the lower limb are associated with considerable pain. Undertreated pain has been reported to be an independent risk factor for delirium in healthy old patients undergoing elective surgery.[4] The prevalence of delirium following lower limb fractures ranges from 13% to 61%. [5,6] Delirium has been associated with delayed recovery, mortality, increased hospital stay, and poorer physical cognitive and affective functions. [5,7]

The International Association for the Study of Pain defined pain as “An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”. Pain is conducted along 3 neuronal pathways that transmit noxious stimuli from the periphery to the cerebral cortex. Modulation of pain occurs peripherally at the nociceptor, in the spinal cord, and in supra-spinal structures. Post-operative pain after orthopedic lower limb surgery is very distressing symptom and major component of post-operative morbidity. Post-operative pain prevents early ambulation which is an important concern to prevent deep vein thrombosis and for rehabilitation. Different modalities can be used to control post-operative pain.[8]Lower extremity blocks are safe and have advantages, such as post-operative pain relief and no need of complete sympathectomy. Recent applications have focused on

post- operative analgesia rather than intra-operative anaesthesia. The use of peripheral nerve blocks has become increasingly popular in the last two decades. With the use of anatomical landmark-based techniques, peripheral nerve stimulators or ultrasound guided techniques, novel types of nerve blocks have been made possible to lower the risk of complications.[5,6] It has been observed that regional anaesthesia provides many advantages such as ability to keep the patients conscious during surgery, maintenance of spontaneous respiration, preservation of protective reflexes, early post-operative mobilization, shortening of hospital stay, prolonged post-operative pain relief, and avoids complications of general anaesthesia. [1,7,9]Various techniques have been used for post-operative pain relief after lower limb surgeries such as patient controlled analgesia pumps with opioids, subarachnoid analgesia, epidural catheters, anterior and posterior lumbar plexus blocks, and non-steroid anti-inflammatory drugs. [3]

Many studies suggest use of sacral plexus block, others have included anterior and posterior nerve block in combination. The dose and drug concentrations also varies and often fixed doses have been used irrespective of patient body weight.[10,11]The findings are conflicting. Most studies have reported beneficial effects. Many studies focused on sciatic nerve block whereas few studies have used sacral plexus block.[11]Hence, an attempt was made in the present research to study the efficacy of peripheral nerve stimulator guided sacral plexus block as a part of multimodal analgesic regimen after below knee orthopedic surgery.

MATERIALS AND METHODS

This prospective observational study was conducted between April 2017 and September 2017. After approval from the scientific advisory committee and institutional ethics committee, written informed consent was obtained from all the patients. Patients aged 18 to 60 years of either sex scheduled for below knee orthopaedic surgery belonging to American Society of Anaesthesiologist (ASA) grade I and II were included. Patients using regular analgesic medications for chronic pain, patients with history of allergy to drug or drug components, patient with bleeding diathesis, and infection at the site of block were excluded from the study.

Sixty indoor patients admitted for below knee orthopedic surgery in Poona Hospital and Research Center were included. Pre-anaesthesia checkup was done one day prior to surgery. The patients were evaluated for any systemic diseases and laboratory investigations were recorded .Details of the procedure was explained to the patients and written informed consent for participation in the study was taken. The patients were educated about the visual analogue scale (VAS) score.

All the patients were preloaded with 10 mL/kg ringers lactate 15 minutes before the surgery. Baseline pulse rate, blood pressure, SpO_2, and ECG were recorded. Peripheral nerve stimulator guided sacral plexus block was given by posterior approach before spinal anaesthesia. The patient was positioned laterally with the leg to be blocked rolled forward onto the flexed knee as the heel rested on the knee of the dependent non-operative leg (modified sim's position). A line was drawn to connect the posterior superior iliac spine to ischial tuberosity. It was divided into three parts and the needle was inserted at the junction of middle 2/3rd and lateral 1/3rd part. After skin disinfection local anesthetic was infiltrated subcutaneously at the needle insertion site. The nerve stimulator was set to deliver a current intensity of 1.5 mA. A 22 gauge, 10 to 12 cm atraumatic insulated needle was advanced until a motor response was elicited (twitches of the foot and toes). After an initial stimulation of the sacral plexus was obtained, the stimulating current was gradually decreased until twitches were still seen or felt at 0.2 to 0.5 mA. The needle was placed properly. After negative aspiration of blood, 20 mL of 0.5 % bupivacaine was injected. Under strict aseptic precautions, using 25 gauge Quincke's spinalneedle, lumbar puncture was performed at L3-L4 space. Spinal anaesthesia was given using 3 mL of 0.5% hyperbaric bupivacaine after sacral plexus block.

Pulse rate, mean arterial pressure, respiratory rate, oxygen saturation, and time to reach peak level of sensory block were noted using pin prick method.

Motor block was assessed with Modified Bromage scale-

a. Complete block (unable to move feet or knee)

b. Almost complete block (able to move feet only)

c. Partial block (just able to move knees)

d. Detectable weakness of hip flexion while supine (full flexion of knees)

e. No detectable weakness of hip flexion while supine

f. Able to perform partial knee bend

Adverse effects such as nausea, vomiting, pruritis, hypotension, bradycardia, respiratory depression, sedation and prolonged sensory and motor blockade were noted. Pain was assessed using VAS score between 0 and 10 (0=no pain, 10= worst pain) at baseline, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24 h post-operatively. Diclofenac sodium 75 mg intra-venous was given slowly as rescue analgesia when VAS score was > 4. Time of supplemental analgesia was noted.

Primary outcome measures were to study duration of sacral plexus block and the requirement of rescue analgesia whereas secondary outcome measures were to study the adverse effects of sacral plexus block. On the basis of a previously published study, [12] a sample size of 60 patients was calculated by a formula [13] with 80 % power and 5 % probability of Type I error to reject null hypothesis.

Data collected were entered in Excel 2007 and analysis of data was done using Statistical Package for Social Sciences (SPSS) version 20, IBM, USA. The data on categorical variables is shown as n (% of cases) and data on continuous variables is shown as mean ± standard deviation (SD).

RESULTS

Sixty patients were recruited between April 2017 and September 2017 to study duration of sacral plexus block and the requirement of rescue analgesia. Of 60 patients studied, 11 (18.3%) were between 20.0 and 29.0 years, 28 (46.7%) were between 30.0 and 39.0 years, 19 (31.7%) were between 40.0 and 49.0 years, and 2 (3.3%) were between 50.0 and 60.0 years. The mean ± SD of age was 36.8 ± 6.9 years. Thirty one patients (51.7%) were males and 29 (48.3%) were females. Of 60 patients studied, 41 (68.3%) were of Grade I ASA and 19 (31.7%) were of Grade II ASA.

Table 1 depicts mean pulse rate, mean blood pressure and mean VAS score at different time intervals post-operatively. Fifty three (88.3%) patients required rescue analgesia between 12 h and < 18 h, whereas 7/60 (11.7%) patients required rescue analgesia

Table 1: Mean pulse rate, blood pressure and VAS score at various time interval post-operatively

Time interval	Mean pulse rate per minute (SD)	Mean BP in mm of Hg (SD)	Mean VAS score (SD)
Pre-op	88.7(6.2)	87.0 (4.0)	
0 h	75.9 (4.2)	84.3 (2.2)	0.00
2 h	76.6 (3.9)	84.3 (2.2)	0.00
4 h	76.6 (3.7)	84.9 (2.4)	0.00
6 h	75.5 (3.2)	84.4 (2.2)	0.52 (0.13)
8 h	75.3 (3.0)	84.4 (2.5)	0.52 (0.13)
10 h	75.9 (3.3)	84.5 (1.9)	1.13 (0.33)
12 h	76.4 (3.3)	84.9 (2.1)	1.52 (0.43)
14 h	76.0 (3.7)	85.3 (1.9)	2.30 (0.98)
16 h	82.6 (5.8)	86.9 (2.8)	3.28 (1.01)
18 h	81.7 (3.4)	85.4 (2.0)	2.42 (0.96)
20 h	80.7 (3.3)	84.8 (1.2)	2.12 (0.55)
22 h	81.3 (3.6)	84.9 (1.4)	2.67 (0.60)
24 h	81.2 (3.5)	84.8 (1.3)	2.87 (0.43)

between 18 and 24 h. Not a single patient had any adverse effects.

DISCUSSION

We conducted a prospective observational study in 60 patients undergoing below knee orthopaedic surgery who received single shot sacral plexus block for post-operative pain relief. Primary objectives were to study duration of sacral plexus block and the requirement of rescue analgesia whereas secondary objectives were to study the adverse effects of sacral plexus block. In the present research not a single patient required rescue analgesia up to 12 h after surgery, 88.3% patients required rescue analgesia between 12 h and < 18 h, whereas 11.7% patients required rescue analgesia between 18 h and 24 h. Not a single patient had any adverse effects.

Parker et al reported that nerve blocks reduced pain score and analgesic requirements of the patients who underwent below knee orthopaedic surgeries. [14] Monsó et al reported that sciatic nerve block in the popliteal fossa for surgery of the dorsal foot was highly effective and comfortable for patients.It provided good post-operative analgesia with no major side effects. [11] Adali et al. stated that spinal anesthesia and combined sciatic nerve/lumbar plexus block (CSLPB) technique in lower extremity orthopedic surgery provided longer duration of anaesthesia. They concluded that CSLPB was effective in lower extremity orthopedic surgeries. [1] Sinha et al. in their study of the efficacy of single-shot sciatic nerve block for post-operative pain management in below knee orthopaedic surgery concluded that single shot sciatic nerve block provided effective pain relief to majority of the patients up to 18 h in below knee orthopaedic surgery and also decreased analgesic drugs requirement post-operatively. Sciatic nerve block was safe with no adverse effects. [15]Swathi et al. tested the clinical efficacy of sciatic nerve block for below-knee orthopaedic surgeries. They reported that sciatic nerve block is an effective and safe method of anaesthesia for below-knee orthopaedic surgeries with no adverse events or haemodynamic instability. [16] Vinod et al. conducted a study to evaluate the adequacy of combined psoas and sacral plexus block (SPB) as a sole anaesthetic agent and duration of post-operative analgesia for unilateral lower limb surgeries. They stated that combined psoas and SPB was a good and safe alternative to neuraxial block in patients undergoing unilateral lower limb surgeries with prolonged post-operative pain relief. [17] All these findings are similar to our study.There were few limitations in the present research such as the onset of sacral plexus block could not be assessed because subarchanoid block was given immediately after sacral plexus block and the patients could not be observed after 24 hours due to logistic issues. Also, we have not compared the two groups like one with only spinal anaesthesia and the other with spinal anaesthesia along with sacral plexus block.

CONCLUSIONS

Single shot sacral plexus block provided effective pain relief up to 24 hours in below knee orthopedic surgery in majority of the patients. It decreased analgesic drugs consumption significantly post-operatively. Patients remained hemodynamically stable after the sacral plexus block in post-operative period. Sacral plexus block is safe with no adverse effects.

Conflict of interest:

Dr. Sujata Shelke, Dr. Sandeep Mutha, and Dr. Deepak Phalgune declare that they have no conflict of interest.

The manuscript has been read and approved by all the authors, that the requirements for authorship as stated earlier in this document have been met, and that each author believes that the manuscript represents honest work.

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