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## USG guided popliteal sciatic and adductor canal block for below knee surgeries and postoperative analgesia in high risk patients

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### Abstract

**Aim:** The aim of the present study is to determine the USG guided popliteal sciatic and adductor canal block for below knee surgeries and postoperative analgesia in high risk patients.

**Methods:** A prospective study was conducted at Bone & Joint hospital an associated hospital of GMC Srinagar, department of Anaesthesiology and critical care medicine, from September 2018 to August 2019. 50 patients with ASA physical status III–IV (diabetes, hypertension, hepatorenal disease, ischemic heart disease), aged 30–70 years were included in this study. Patients allergic to local anaesthetics, on opioids and other analgesics for chronic pain, a refusal for peripheral nerve block and with neurological deficits were excluded from the study. Routine investigations, coagulation profile, renal and hepatic function tests were obtained and ‘nil per oral’ order was placed six hours prior to the surgery. Analyse the block success rate and sensory and motor block onset time, hemodynamic parameters, duration of post operative analgesia and patient’s overall satisfaction.

**Results:** A total of 50 patients with significant co morbidities scheduled for below-knee surgery were included in this study. All patients obtained an adequate sensory and motor blockade and the surgery was performed successfully under ultrasound-guided popliteal sciatic and adductor canal block, with no additional analgesic requirement. The mean duration for sensory and motor block onset time was  $3.45 \pm 0.52$  and  $4.77 \pm 0.47$  minutes respectively. Hemodynamic parameters were maintained stable without gross fluctuation from baseline value throughout the procedure. Average duration of post-operative analgesia as assessed by NRS was  $\pm 0.9$  hours. Patient satisfaction as assessed by three-point Lickert’s scale was satisfactory, with 80% of patients were graded as per Lickert’s scale 1 and 20% of patients were graded as per Lickert’s scale 2.

**Conclusion:** Ultrasound-guided combined popliteal sciatic and adductor canal block is an effective alternative anaesthetic technique for below-knee surgeries with better stability of hemodynamic parameters and pain management in high-risk patients.

**Keywords:** USG, popliteal sciatic, adductor canal, knee surgeries

### Introduction

Total knee arthroplasty is satisfactory for improving pain and recovery from arthritis, but many patients complain of postoperative pain<sup>[1, 2]</sup>. Postoperative pain is an important factor affecting the outcome of surgery that can make rehabilitation difficult and limit the range of motion of the joint<sup>[3]</sup>. Nonsteroidal analgesics, narcotic analgesics, patient-controlled analgesia, and periarticular multimodal drug injection (PMDI) have been used to relieve postoperative pain<sup>[4-6]</sup>. Recently, peripheral nerve blocks such as femoral nerve block (FNB), adductor canal block (ACB), and sciatic nerve block have been used to control pain after total knee arthroplasty<sup>[7-9]</sup>. FNB may provide effective pain control, but it may also cause weakness in the quadriceps muscle after surgery, causing a limitation in gait<sup>[7]</sup>. Meanwhile, ACB is effective in relieving pain without causing weakness in the quadriceps muscle<sup>[10]</sup>. However, ACB is less effective in relieving posterior knee pain<sup>[11]</sup>. To compensate for this, ACB is combined with sciatic nerve block and PMDI<sup>[12]</sup>. Recently, a procedure using ultrasound guided local anaesthetic infiltration between the popliteal artery and the capsule of the knee (IPACK) has been shown to provide significant posterior knee analgesia without affecting the common perineal nerve<sup>[12]</sup>. IPACK can also be performed to reduce the pain in the posterior knee, with virtually no risk of injury to the nerves or blood vessels. Thus, we hypothesised that peripheral nerve blocks are an effective alternative to central neuraxial blockade and general anaesthesia in high-risk patients undergoing below-knee surgeries.

## Materials and methods

A prospective study was conducted at Bone & Joint hospital an associated hospital of GMC Srinagar, department of Anaesthesiology and critical care medicine, from September 2018 to August 2019, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives. The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients. 50 patients with ASA physical status III–IV (diabetes, hypertension, hepatorenal disease, ischemic heart disease), aged 30–70 years were included in this study. Patients allergic to local anaesthetics, on opioids and other analgesics for chronic pain, a refusal for peripheral nerve block and with neurological deficits were excluded from the study. Routine investigations, coagulation profile, renal and hepatic function tests were obtained and 'nil per oral' order was placed six hours prior to the surgery.

## Methodology

In the operation theatre, standard monitors were attached such as an electrocardiograph, non-invasive blood pressure and pulse oximeter. All sterile aseptic precautions were taken and the ultrasound machine (LOGIQT Me GE Healthcare, India) was placed on the opposite side of the limb that had to be blocked. For adductor canal block, the patient lay supine with an extended leg in a neutral position or rotated slightly outwards. A high-frequency linear ultrasound probe was placed on the anterior aspect of the patient's thigh at the mid-thigh level. The femur bone was identified and probe moved medially until the boat-shaped Sartorius muscle and femoral vessels lying beneath it was visualised. An 18 gauge needle was inserted via in-plane technique; 10 ml of 0.2% ropivacaine was deposited on either side of the femoral artery after negative aspiration. Then for popliteal sciatic nerve block, the patient was lain laterally on the opposite side of the limb which has to be blocked. The limb to be blocked was flexed partially at hip and knee joint. Using a high-frequency linear probe, a scan of popliteal fossa was conducted to identify separate tibial and common perineal nerves lying superficially and posteriorly to popliteal artery. Movement of the probe proximally brings tibial and common perineal nerves together to form the sciatic nerve at a variable point, above the popliteal crease. At this level, via in plane technique, using 18 gauge needle, 20 ml of 0.2% ropivacaine was deposited after negative aspiration and real-time spread of local anaesthetic was visualised in subpar neural space around the sciatic nerve. All the patients received 0.03 mg/kg of intra-venous midazolam and oxygen was supplied by facemask throughout the procedure. Surgery was started after adequate sensory and motor blockade was achieved. In patients with failure to achieve adequate surgical anaesthesia after 20 minutes of administration of block, it was considered as a block failure and converted to general anaesthesia. Tourniquet was not used in any of the cases.

The aim of the study to analyse the block success rate and sensory and motor block onset time, hemodynamic parameters, duration of postoperative analgesia and patient's overall satisfaction. Sensory block and motor block onset was assessed after two minutes following administration of block and every 30 seconds thereafter, by pinprick test and movements at the ankle, respectively, and the time of block

onset was noted. Sensory block onset was defined as time from completion of block administration to loss of pin-prick sensation and motor block onset as the time from completion of block administration to loss of movements at ankle joint. Haemodynamic parameters including heart rate, blood pressure and peripheral oxygen saturation were recorded at regular time intervals. The time required for first rescue analgesia and any complications were noted. After shifting the patient to post anaesthesia care unit, assessment of pain was done every 30 minutes using numeric rating scale (NRS, 0–10 scale, with 0 being no pain and 10 being worst pain), when the NRS score was more than 3, injection Tramadol 1 mg/kg was given intravenously as a rescue analgesic. Duration of post-operative analgesia was defined as the time interval between completion of block administration and first rescue analgesia (NRS>3). Twelve hours post-operatively, overall patient satisfaction was assessed based on three point Lickert's scale (1, most satisfactory; 2, satisfactory; 3, not satisfactory). Descriptive statistics of the study were calculated and the data was analysed using an SPSS statistics 20.0 program. The continuous data were expressed as numbers, mean and standard deviations and qualitative data were expressed as numbers and percentages.

## Results

A total of 50 patients with significant co morbidities scheduled for below-knee surgery were included in this study [Table 1]. All patients obtained an adequate sensory and motor blockade and the surgery was performed successfully under ultrasound-guided popliteal sciatic and adductor canal block, with no additional analgesic requirement [Table 2]. The mean duration for sensory and motor block onset time was  $3.45\pm 0.52$  and  $4.77\pm 0.47$  minutes respectively. Hemodynamic parameters were maintained stable without gross fluctuation from baseline value throughout the procedure. Average duration of post-operative analgesia as assessed by NRS was  $\pm 0.9$  hours. Patient satisfaction as assessed by three-point Lickert's scale was satisfactory, with 80% of patients were graded as per Lickert's scale 1 and 20% of patients were graded as per Lickert's scale 2. There were no intra-operative complications recorded.

**Table 1:** Patient characteristics

Age (years)	60.55±12.98
Sex (Male/Female)	36/14
ASA (III/IV)	38/12
BMI (kg/m <sup>2</sup> )	24.12±3.66
<b>Type of surgery</b>	Number of patients
Below knee amputation	34
Diabetic foot debridement	8
Distal tibia plating	8

**Table 2:** Block characteristics

Success rate	50/50 (100%)
Sensory block onset	3.45±0.52 minutes
Motor block onset	4.77±0.47 minutes
Duration of analgesia	7.7±0.9 hours
Lickert's satisfaction scale	1(80%), 2(20%)

## Discussion

High-risk patients with sepsis, multi-organ dysfunction, cellulitis, coagulopathy and other significant co morbid

conditions serve a particular challenge in perioperative anaesthetic management. Neuraxial blocks can be catastrophic due to instability of hemodynamic parameters and coagulopathy.<sup>13</sup> General anaesthesia can result in high morbidity with significant hypotension, myocardial depression and mechanical ventilation-related complications.<sup>14</sup> Ultrasound-guided peripheral nerve blocks remains a safe alternative for such patients.<sup>15,16</sup> There are few case reports based on lower limb surgeries performed under peripheral nerve blocks. Baddoo *et al.* published a case series of ten patients posted for above-knee amputation surgery, land mark technique of three-in-one block and Labat's approach of sciatic block were administered and reported as a partial block in the three cases.<sup>17</sup> However, the use of ultrasound ensures adequate block and facilitates rapid block onset and prolonged duration with a decrease in drug dosage and systemic complications. Shamim *et al.* studied combined femoral and sciatic nerve block under ultrasound guidance and reported it a safe and satisfactory anaesthetic technique for above and below-knee amputation surgeries in high-risk patients.<sup>18</sup> But, the lateral cutaneous nerve of the thigh from lumbar plexus and the posterior cutaneous nerve of the thigh from sacral plexus should be blocked to achieve the complete anaesthesia for above-knee surgeries.<sup>19</sup> Proper anatomical knowledge is the key point for the success of peripheral nerve blocks. The two branches of the sciatic nerve: common peroneal and tibial nerve supply the leg and foot along with a sensory terminal branch of femoral nerve i.e. saphenous nerve, which provides sensory innervation to the medial part of leg and foot. Thus popliteal sciatic and adductor canal block provide adequate anaesthesia for below-knee surgeries. Yun Suk Choi *et al.* reported below-knee surgery successfully performed in two patients with severe cardiac dysfunction under ultrasound-guided femoral and popliteal sciatic nerve block with the stable intra-operative hemodynamic parameters.<sup>20</sup> But presently there are no published literature on ultrasound-guided combined popliteal sciatic and adductor canal block for below-knee surgeries. The present case series affirms successful below-knee surgeries under combined ultrasound-guided popliteal sciatic and adductor canal block as sole anaesthetic technique, with rapid sensory and motor block onset, decrease the dosage of local anaesthetic agent, better stability of hemodynamic parameters, good post-operative analgesia and no adverse complications. The most important independent predictor of persistent pain is the degree of pain relief in the immediate post-operative period. An adequate post-operative pain management has been reported to prevent the development of chronic pain.<sup>21</sup> Peripheral nerve block has an additional advantage of adequate post-operative pain management and in our study; the average duration of post-operative analgesia was 7.7±0.9 hours. We acknowledge a few limitations of our study: only a single bolus dose of the drug was administered. Single-shot adductor canal and sciatic blocks are simple to perform but provide analgesia for a limited duration, which can be overcome by inserting a perineural catheter and performing continuous perineural local anaesthetic infusions. Secondly, dual technique with peripheral nerve stimulator and under the ultrasound guidance further increases success rate and reduces complications, particularly, in high-risk patients. Further randomised trials are required to establish the superiority of peripheral nerve block over the central neuraxial block and general anaesthesia for lower limb

surgeries in high-risk patients.

## Conclusion

Ultrasound-guided combined popliteal sciatic and adductor canal block is an effective alternative anaesthetic technique for below-knee surgeries with better stability of hemodynamic parameters and pain management in high-risk patients.

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