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THE HEMODYNAMIC INPACT OF ULTRASOUND GUIDED PERIPHERAL NERVE BLOCKS DURING BELOW KNEE SURGERIES IN HIGH-RISK PATIENTS- OUR EXPERIENCE

Anaesthesiology

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ABSTRACT

High risk individuals usually present with a variety of co-morbidities warranting a vigilant monitoring under anaesthesia to decrease associated morbidity and mortality. Although traditionally regional anaesthesia and general anaesthesia have been administered, wide fluctuations of hemodynamic parameters have been reported. Ultrasound guided peripheral nerve blocks provide adequate analgesia and anaesthesia while providing better hemodynamic stability and hence may be superior to other techniques. A total of 15 patients aged 45-81 years undergoing below knee surgeries were reviewed. The hemodynamic parameters, onset of sensory and motor blockade and duration of analgesia were noted. The pulse rate and blood pressure were stable with less than 10 % variation from baseline. The mean duration for onset of sensory and motor block was 3.9 + 0.56 and 5.3 + 0.4 minutes respectively. None of the patients required supplemental analgesics intra-operatively. The ultrasound guided combined femoral-sciatic nerve block provides excellent hemodynamic stability while minimizing complications.

KEYWORDS

Ultrasound, combined femoral-popliteal sciatic block, high risk patients, hemodynamic stability

INTRODUCTION

With the advancements in anatomy and physiology, the life span of patients with multiple co-morbidities has increased in the past few decades. We come across a significant number of patients in this subset to present in the emergency department for emergency surgeries.

Although it is always prudent to optimize such patients before posting them for surgery, more often than not, time is a constraint. Therein comes the role of an anesthesiologist who acts an acute care physician carefully balancing the physiology and changes associated with anesthesia and surgery to create a fine balance. It is therefore imperative to decide upon a plan of anesthesia which is safe and effective for these patients.

Although the anesthetic plan should be tailored to each individual, in most cases central neuraxial blockade and general anesthesia may be dangerous due to profound hypotension caused by anesthetic drugs and sudden sympathetic blockade (Shamim et al, 2018). Central neuraxial block and general anaesthesia in patients with significant comorbidities are associated with considerable peri-operative morbidity and mortality (Arjun et al, 2019) .There are few case reports on femoral, obturator and sciatic nerve blocks in patients with multi-organ dysfunction undergoing lower limb surgeries (Shamim et al,2018, Tantry et al,2010, Choi et al, 2015).

An alternative technique is to perform a USG guided regional block of the affected lower limb. The major advantage of using peripheral nerve blocks for below knee surgeries is the hemodynamic stability provided along with adequate surgical anesthesia intra-operatively. The presence of real time ultrasound depicting accurate localization of the nerve and blood vessels provides a higher safety of margin as compared to other methods (Attri et al,2016, Perlas et al, 2008, Latzke et al,2010).

The objectives of this study were to study the hemodynamic stability associated with USG guided femoral and popliteal sciatic nerve block in high-risk patients undergoing below knee surgeries.

MATERIALAND METHODS

Present study was a single center, prospective clinical study, conducted in the Department of Anesthesiology, Dr V. M. G. M. C., Solapur, India. After approval of the ethics committee, Study was done over a period of 18 months (July 2021 to January 2023).

Inclusion Criteria: Patients of either sex, aged between 35-85 years, belonging to ASA Grade III, IV and V(Diabetes, Hypertension, Ischemic heart disease, head injury, hepatorenal disease) posted for below knee surgeries (emergency or planned) willing to participate.

Exclusion Criteria: Patient refusal, History of allergy to local anesthetics. Patients with skin infection at the site of Block.

All patients were counselled regarding the procedure and written informed consent was obtained. A routine pre-anesthesia checkup was performed and routine NPO protocol was followed. All patients were asked to continue their usual doses of medications for associated co-morbidities. Sedative pre-medications were avoided prior to surgery. An Intravenous line was secured, and standard monitors were applied. The monitoring comprised of pulse oximetry, noninvasive blood pressure measurement, heart rate, ECG. Oxygen was supplemented with the help of a facemask at 5-6 L/min. Safe dose of Bupivacaine was calculated as 2-3 mg/kg. Titrated dose of midazolam (0.5 – 1 mg) was given during the procedure to provide comfort to the patient during procedure.

For performing the popliteal sciatic nerve block, the patient was given a lateral decubitus position with the affected limb on the non-dependent side partially flexed at knee and hip joints. Following all aseptic precautions, the local area was cleaned and local anesthetic skin infiltration was done. Using a high frequency linear probe, the popliteal fossa was scanned to locate the tibial and common peroneal nerve. After identification, the transducer was used to trace these nerves proximally where they united to form the sciatic nerve at a variable point above the popliteal crease. At this level, out of plane technique was used to approach the nerve, 20 ml of 0.25 % bupivacaine was deposited after negative aspiration and spread of the drug was visualized around the nerve. For administration of the femoral block, the patient was asked to lie supine. The high frequency linear transducer was placed at the inguinal ligament and femoral nerve and vessels were located. Following all aseptic precautions, an in plane technique was used to advance the needle towards the femoral nerve and bupivacaine 0.25% 15 ml was deposited around the nerve.

The primary objective was to assess the hemodynamic stability. The secondary parameters of assessment included onset and duration of sensory blockade, onset and duration of motor blockade, need for rescue analgesics, complications and post operative analgesia. 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. Patients were assessed every 15 minutes till the end of the procedure. After completion of Surgery every 30 mins for 2 hours and then hourly for 24 hours. Assessment of post operative pain was done by Visual analogue score (VAS). VAS score ranges from 0-10, 0 – no

pain to 10- worst pain. The assessment of pain was done hourly in the post operative period and a rescue analgesic (NSAID) was administered when the score was above 5. The observations and particulars of each patient were recorded in the proforma. Statistical analysis was done using descriptive statistics.

RESULTS

A total of 15 patients who fit in the inclusion criteria were included in the study (table 1). All participants receiving ultrasonography guided femoral and popliteal sciatic nerve block had an adequate sensory and motor blockade. The surgery was conducted successfully without any complications (Table 2). All hemodynamic parameters were maintained within a 10% variation from baseline (Figure 1,2). There were no gross fluctuations during the study. The mean duration for onset of sensory and motor block was 3.9 + 0.56 and 5.3 + 0.4 minutes respectively. None of the patients required supplemental analgesics intra operatively. The average duration of post- operative analgesia was 8 + 0.6 hours.

Table 1: Demographics

Age (years)	54.65 ± 17.62
Sex (Male/Female)	9/6
ASA (III/IV/V)	8/5/2
BMI (kg/m2)	24.12 ± 2.10

Table 2 : Type of Surgeries

Type of surgery	No. of patients
Below knee amputation	4
Debridement/Fasciotomy	9
Distal Tibia plating	2

Table 3: Block characteristics

Success rate	15/15
Sensory block onset	3.9 ± 0.56 minutes
Motor Block onset	5.3 ± 0.40 minutes
Duration of analgesia	10 ± 0.6 hours

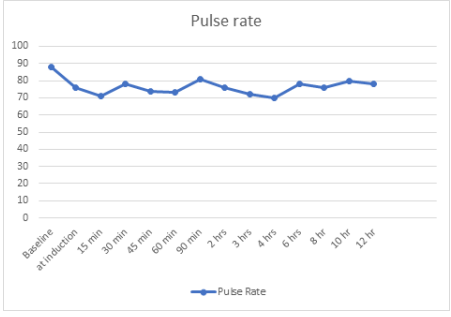

Figure 1: Pulse Rate

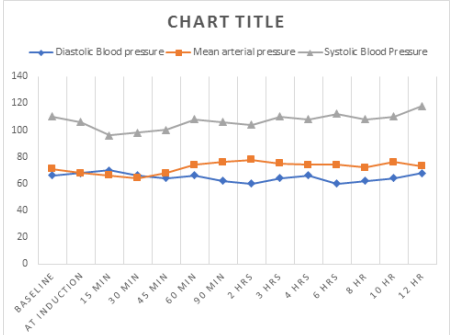

Figure 2 : Blood Pressure

DISCUSSION

Most commonly used anaesthetic technique for lower limb procedure is CNB, either spinal or epidural anaesthesia. However, its use is limited in compromised cardiac status due to frequent hypotension caused by sympathetic blockade(Fanelli et al,1998).

Fanelli et al[9] found out that even in ASA I&II patients in whom a unilateral spinal block was performed for lower limb surgery, the mean arterial pressure decreased by about 15% from the baseline values, whereas in patients who were given a sciatic-femoral block there was no change in mean arterial pressure. Also, the cardiac index decreased by 15–20% in the group who were given a unilateral spinal block whereas there was no change in the group given a sciatic-femoral nerve block. According to study conducted by Hou Yee Lai et al compared to the peripheral nerve block group, the group which received sub arachnoid block had a larger number of patients with significant hypotension and more patients who required vasopressor boluses.

The lower limb is supplied by the sciatic nerve together with nerves from the lumbar plexus. The thigh is supplied by the femoral nerve, the lateral cutaneous femoral nerve, and the obturator nerve (all from the lumbar plexus). In addition, a narrow posterior slip of the thigh is supplied by the posterior femoral cutaneous nerve (S2 / S3) which enters the thigh together with the sciatic nerve but then diverges from the sciatic nerve. The leg below the knee is supplied by the tibial and peroneal branches of the sciatic nerve, as well as the saphenous nerve which is a continuation/branch of the femoral nerve. Thus, for below knee surgeries, a sciatic nerve block together with a femoral nerve block is adequate (Baddoo et al, 2009).

Cardiac dysfunction and hemodynamic instability are the consequence of severe sepsis and may consist of cardiac contractility impairment, reduced cardiac index, and reduced ejection fraction (Hunter et al,2010). Anaesthetic drugs usually reduce myocardial contractility and induce vasodilation by direct action on heart and vasculature. They generally worsen the condition of patient with sepsis (Yoon et al,2012). In addition to this, some diabetics have autonomic neuropathy which impairs cardiovascular compensation when they are subjected to physiological changes that occur during anesthesia.

Considering the above factors and available techniques, the combined femoral and sciatic nerve blocks for lower limb anaesthesia was planned.

The use of ultrasonography has resulted in safer techniques in providing peripheral nerve blocks in high-risk patients. The possibility of real- time imaging has resulted in lesser incidences of complications and provided a more rapid block onset and prolong block duration, with the added advantages of a decrease in drug dosage and a reduction in the incidence of local anesthetic toxicity (Marhofer et al,2005 and Van et al 2006).

CONCLUSION

Peripheral nerve blocks in high-risk patients undergoing below knee surgeries are associated with adequate anesthesia and cardiovascular stability. In addition, they also provide post-operative analgesia. Hence it can be concluded that combined femoral and sciatic block are a satisfactory alternative to central neuraxial blockade.

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