A COMPARATIVE STUDY OF SCIATIC NERVE BLOCK FOR LEG AND FOOT SURGERY IN ELDERLY PATIENTS WITH THE HELP OF NERVE LOCATOR VS PARAESTHESIA ELICITATION TECHNIQUE

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ABSTRACT

Background: Commonly used methods of performing peripheral nerve blocks include elicitation of paresthesia and motor response to an electrical stimulus. The objective of this study was to compare the efficacy and reliability of these two methods in performing sciatic nerve block for lower limb surgery in elderly patients.

Method: Sixty patients, 60 – 90 years of age were randomly divided into two groups in this observer blinded study. In Group I Sciatic nerve block was established with a nerve locator and in group II paraesthesia elicitation technique was used. 20 ml of 0.5% bupivacine was administered in both groups. Haemodynamic parameters were recorded before and after the sciatic nerve block. We recorded the time of onset and extent of both sensory and motor blocks. The severity of pain was also noted in both groups.

Results: Statistically significant differences were seen in depth of sensory and motor blocks and degree of pain between groups ($P < 0.05$). The time of onset of block was same in both groups and haemodynamics remained stable before and after the block.

Conclusion: The use of nerve locator is more effective and successful in performing peripheral nerve blocks in comparison to paresthesia elicitation technique.

Key words: Sciatic nerve block, Nerve locator, sensory, motor.

BACKGROUND

Peripheral nerve blocks are safe and effective regional anaesthesia technique for various surgical procedures. A successful block can be achieved by correct location and deposition of anaesthetic agent near the nerve.[1] Various techniques in use are, paresthesia elicitation, nerve stimulator and more recently ultrasonic visual guidance. The use of a peripheral nerve stimulator (PNS) has been shown to be a popular technique for regional anaesthesia.[2,3]

Changes in central and peripheral nervous system due to age may influence the peripheral nerve blocks. There is a decrease in number and density of nerve fibers, motor unit action potentials and degeneration of axons with increase in age.[4] The effect of these changes was demonstrated by Dorfman and Bosley who found age dependent decrease in conduction velocity of both motor and sensory fibers.[4,5]

Peripheral and neuraxial nerve blocks can provide superior pain management, improve patient outcome and decrease the risk of complications in elderly patient. The presence of coexisting disease such as Hypertension, Diabetes, COPD makes them vulnerable to the side effects of General Anaesthesia.[6] Sciatic nerve block is a useful technique for lower limb surgery in elderly patients. Exact nerve localization on identification of motor response with nerve locator can allow higher success rate of block as compared to elicitation of paresthesias. This study was conducted to evaluate and compare the effectiveness of sciatic nerve block with a nerve locator and that of paresthesia elicitation technique in elderly patients.

METHOD

This observer blinded protocol was approved by Hospital Ethics Committee and Department of Anesthesia, King Edward Medical University (KEMU). Sixty patients aged 60 – 90 years, ASA II and III status scheduled for leg and foot surgery were enrolled after written informed consent.

Patients receiving analgesic therapy, on anticoagulants, diabetic, with neuromuscular disease, central or peripheral neuropathies and skin infection at site of injection were excluded. Patients were divided into two groups of 30 each, randomly using lottery method. In Group I sciatic nerve was localized with the help of a nerve locator and in 30 patients block was performed by elicitation of paresthesia, (Group II).

In the operation theatre before the nerve block was established all patients were monitored (SpO_2,

electrocardiogram, non-invasive arterial pressure) and intravenous access was secured. 0.04 mg/kg midazolam intravenously was given to relieve anxiety and major discomfort while the block was administered.

In Group I, sciatic nerve block was performed with the help of a nerve locator by classic posterior approach. The nerve stimulator was set to deliver a current of 1.5mA. At elicitation of dorsiflexion of foot, the current was reduced and 20ml of 0.5% bupivacaine was injected when this response was visible even with a current of 0.5mA (Fig. 1). In Group II, patients were administered 20 ml of 0.5% bupivacaine after localization of sciatic nerve by elicitation of paresthesia.

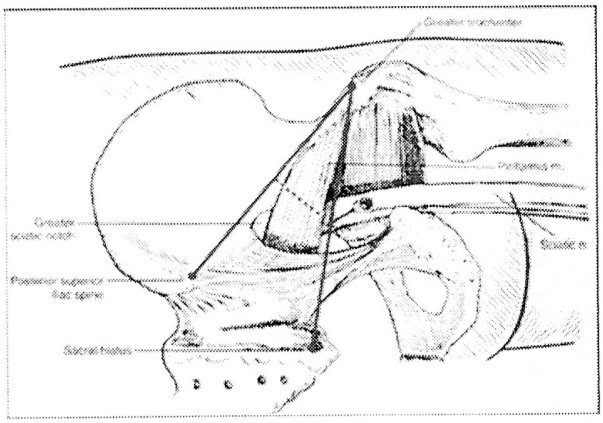


Fig. 1: *Anatomical Landmarks.*

Table 1: *Extent of Sensory and Motor Block.*

Sensory Block Response to Pinprick			*Motor Block Movement of Foot*		
Normal	Blunted	Absent	Normal	Blunted	Absent
0	1	2	0	1	2

One of the investigators of the study who was blinded to the nerve block technique assessed the motor and sensory block, degree of pain and effectiveness of block. The time of onset of motor and sensory block was recorded. Extent of sensory block was determined using a 3 point rating scale. A score of < 2 was considered incomplete (Table 1). Motor block was checked by asking the patient to dorsiflex the foot and was rated on a 3 point scale. A score of 2 was considered as complete block (Table 1). The degree of pain was assessed by verbal rating scale on a 4 point rating. Patients reporting VRS of 1 and more than 1 were given 0.5 mg/kg of nalbuphine intravenously. In patients with inadequate surgical conditions, G/A was induced (Table 2).

The effectiveness of block for surgical anaesthesia was rated as successful (patient expressing no discomfort throughout the procedure), adequate (mild discomfort treated with narcotic) and inadequate (required general anaesthesia or ketamine).

Table 2: *Pain Score by Verbal Rating Scale.*

No Pain	*Mild to Moderate*	*Severe*	*Unable*
1	0	2	3

Statistical Analysis

Patient characteristics were reported as mean ± SD. Haemodynamics were analysed with repeated measures of ANOVA. Time of onset, degree of sensory and motor block and pain were analysed with Kruskall Walis test.

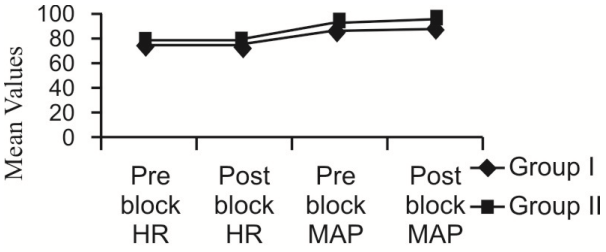
RESULTS

Patient characteristics showed no significant difference (Table 3).

Table 3: *Patient characteristics.*

	Group I (N = 30)	*Group II (N = 30)*
Age (years)	73.90 ± 5.1	75.4 ± 5.9
Male / female	25/5	22/8
Weight (kg)	64.3 ± 6.8	60.8 ± 6.3

Onset time was same in both groups. Haemodynamic parameters remained stable in both groups after the block (Table 4).



HR = Heart rate
MAP = Mean Arterial Pressure

Table 4: *Haemodynamics.*

In group I, complete sensory block was achieved in 28 patients (94%) while partial block seen in 2 (6%) patients. In group II, complete sensory block was seen in 11 (36% patients and 19 (64%) showed a partial block (Table 5, Fig. 2).

In group I, 50% of patients showed complete motor block and 50% had decreased movements.

Table 5: *Sensory Block p = 0.0000.*

	Group I	*Group II*
2	28 (94%)	11 (36%)
1	2 (6%)	19 (64%)

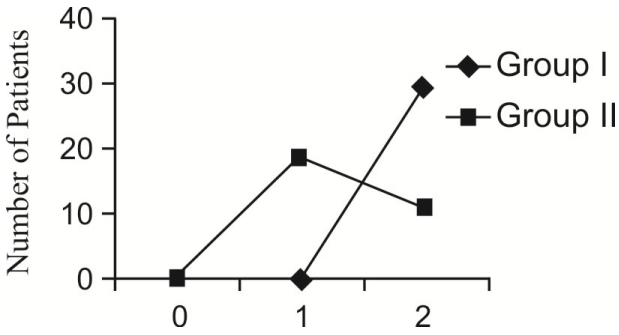


Figure 2: *Sensory Block.*

Twenty percent patients of group II were seen with complete motor block (a score of 2), 63% had decreased movement (score of 1) and in 10% there was no effect (Table 6, Fig. 3).

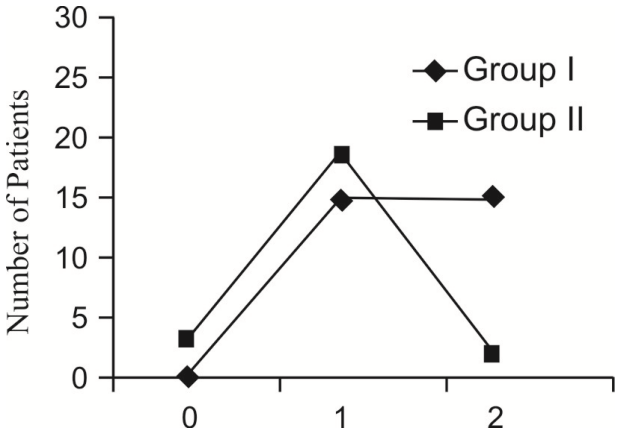


Figure 3: *Motor Block.*

Table 6: *Sensory Block p = 0.0000.*

	Group I	*Group II*
2	15 (50%)	8 (24%)
1	15 (50%)	19 (66%)
0		3 (10%)

Successful surgical anaesthesia was achieved in 28 patients of group I and two patients were supplemented with ketamine. In group II complete analgesia was observed in 40% of patients (VRS score 0). Mild to moderate pain occurred in 50% of patients on bone manipulation and were supplemented with ketamine. In 3 patients (10%), severe pain occurred and general anesthesia was administered (Table 7, Fig. 4).

Table 7: Pain Scores *p = 0.0005.*

	Group I	*Group II*
0	30 (100%)	12 (40%)
1		15 (50%)
2		0
3		3 (10%)

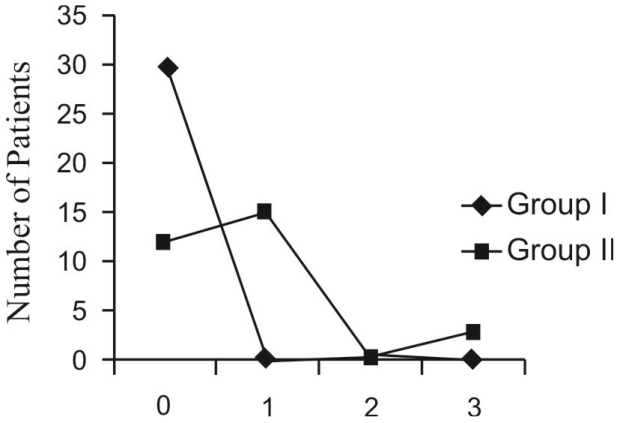


Figure 4: *Pain Score.*

Statistically significant difference were seen in sensory block, motor block and verbal rating scale ($P < 0.05$) between the groups.

DISCUSSION

Regional anaesthesia of peripheral nerve trunks is widely used for pain relief and adequate surgical conditions during surgery. PNB has the advantage of avoiding nausea, vomiting, providing better postoperative analgesia, early recovery, and promoting early discharge. Recent advances in ultrasound allow visualization of nerves and spread of local anaesthetic to perform PNB.[7,8] Alternative techniques rely on electrical stimulation to localize nerve and on anatomic landmark. In our institution, due to financial constraints the two most common techniques used for nerve localization have been nerve stimulation and mechanical elicitation of paresthesia.

Nerve locator allows precise location of nerve and a motor response seen with less than 0.5mA current ensures that the needle is in close proximity of nerve.[9] This allows deposition of drug in close vicinity of nerve and reduces the risk of an intraneural injection and mechanical needle trauma to the nerve

minimizing the possibility of neuropathy.[10,11] A constant communication with the patient expedites the accomplishment of block and a dense and long lasting block is achieved.[12]

Sciatic nerve block is a useful technique for lower limb surgery in elderly patients of ASA II and III in whom central neuraxial block and general anaesthesia is avoided. It decreases the risk of cardiovascular complications and side effects of general anaesthesia.[13] Naja et al showed that combined sciatic paravertebral nerve block for hip fracture repair in elderly patients led to a lower incidence of intraoperative hypotension and need for postoperative admission to ICU / HDU, when compared to patients receiving general anaesthesia.[14]

Our study assessed the efficacy of sciatic nerve block in elderly patients with the help of nerve locator versus paresthesia elicitation technique. Significant difference in the quality of anaesthesia was seen in our study ($p < 0.05$) between the two techniques. The block with nerve locator elicited dense sensory, moderate motor block and successful surgical anaesthesia and analgesia in 94% of patients. Paresthesia elicitation technique showed moderate sensory and mild motor block in patients. Fifty percent patients complained of pain on bone manipulation and ketamine was given. Haemodynamic stability was seen with both techniques.

The duration of sensory and motor block we observed in our study is in accordance with that reported by Hanks et al. (7 – 8 hours).[4] Similar onset time i.e. 30 minutes was seen by Marhofer et al. who used same concentration and volume of bupivacaine as in our study.[15]

In comparison to our study, Cuvillon et al showed increase in onset time (50 minutes) and duration of block (18 hours) with 40 ml of 0.5% bupivacaine. The use of large volume of bupivacaine by Cuvillon et al. could account for the difference in duration of block. The decreased onset time of block in our study (30 Minutes) can be due to more precise localization of nerve with a current < 0.5.[16]

Studies in the past have supported paresthesia elicitation technique. Horlocker et al reported an increased success rate of paresthesia technique (90%) over use of nerve stimulator (83%).[17] Unlike the results of our study, Naseem Laiq et al. showed good results while only eliciting paresthesia and did not require supplementation but were comparable with our study regarding stability of haemodynamic parameters.[6]

Several prior studies have evaluated the efficacy of nerve stimulator technique. Sia et al. in 2000 supported strongly the use of nerve stimulator in comparison to paresthesia technique. They found incidence of complete block greater in nerve stimulator group (91% vs 70%; $p < 0.05$) and concluded that use of nerve stimulator resulted in a shorter time to perform the block, onset time and total anaesthetic time.[18]

Davies and Mcglade also favoured the use of nerve stimulator as a reliable technique for nerve localisation in their study of one hundred sciatic nerve blocks: a comparison of localisation techniques.[19] In a study by Karaca et al. the use of low current nerve stimulation to localize brachial plexus resulted in 95% success.[20]

In an effort to assess the efficacy of nerve stimulation technique we compared it with elicitation of paresthesia. We did not measure the sedation levels and kept patient responsive to our commands to avoid intra-neural injection indicated by burning pain. Another limitation of our study is that we did not measure mean performance time.

In *conclusion*, the use of a nerve stimulator provides effective and successful peripheral nerve block in comparison to paresthesia elicitation technique. However further studies are required to compare the duration of anaesthesia and analgesia with different concentrations of bupivacaine and ropivacaine which can add to patient comfort in postoperative period with safety.

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