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Supraclavicular Block Using Conventional and Nerve Locator Methods – A Clinical Comparative Study

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Abstract **Original Research Article**

About 60 patients of ASA grade I and II undergoing upper limb surgeries were randomly assigned into two groups, Group C and Group NL. In Group C, supraclavicular brachial plexus block was done by conventional subclavian perivascular approach by eliciting paresthesia and in group NL, by the nerve locator guided approach. 15ml of 0.5% bupivacaine and 15ml of 2% lignocaine with 1:2,00,000 adrenaline as the local anaesthetic was used for both the groups. Time taken for the block performed by nerve locator was little longer than the conventional subclavian perivascular technique. The onset of sensory and motor blockade is found to be earlier in the nerve locator technique (7.59±4.35 min and 11.03±4.06 min) compared to the conventional subclavian perivascular technique (11.29±6.23min and13.26±4.25 min).The duration of sensory and motor blockade is found to be prolonged in nerve locator technique (6.56±1.10min and 6.32±1.33min) than conventional subclavian perivascular technique (5.03±1.36 min and 5.04±1.23). Analgesic requirement and Complications were reduced in nerve locator technique compared to conventional subclavian perivascular technique. Nerve locator technique has a higher success rate compared to the conventional subclavian perivascular technique.

Key words: Brachial plexus, nerve block, nerve locator, conventional method, anaesthesia.

INTRODUCTION

Brachial plexus blocks provide a wonderful alternative to general anaesthesia for upper limb surgeries [1]. They achieve near-ideal operative conditions by providing complete and prolonged pain relief, muscle relaxation, maintaining stable intra-operative hemodynamic and adequate sympathetic stability. The sympathetic stability decreases postoperative pain, vasospasm and oedema. Among the various approaches of brachial plexus block, supraclavicular approach is considered as easiest and effective. It also has the reputation of providing most complete and reliable anaesthesia for upper limb surgeries. It is carried out at the level of trunks of brachial plexus where it is more compact i.e., at the middle of brachial plexus, resulting in homogenous spread of anaesthetic solution throughout the plexus with a faster onset and complete block.

The first brachial plexus block was performed by William Stewart Halsted in 1882. He used cocaine to perform the block after directly exposing the brachial plexus within the neck [2]. In 1913, Kulenkampff introduced the classical supraclavicular approach of brachial plexus block [3]. In 1964, Winnie and Collins introduced subclavian perivascular approach of brachial plexus block. The conventional subclavian perivascular paresthesia technique being a blind technique may be associated with higher failure rate, injury to nerves and vascular structures [4]. To minimize these drawbacks, various techniques and approaches were described. Among them, Peripheral nerve locator offers eases of location of anatomical structure. It is one of the methods offering safe block of superior quality by optimal needle positioning [5]. Newer techniques like ultrasound guided technique and Peripheral nerve locator has improved success rate with excellent localization and improved safety margin [7].

This aim of this study was to compare the conventional subclavian perivascular approach after eliciting paresthesia and the Nerve locator technique for supraclavicular brachial plexus block with regards to time taken for the procedure, onset and duration of block, success rate, overall effectiveness of the block and incidence of complications involved

MATERIALS & METHODS

The randomised controlled study was conducted at Kakatiya medical college, Warangal,

undergoing elective surgeries of upperlimb under regional anaesthesia. Approval was taken from the Institutional Ethical Committee before commencing the study. Written and Informed Consent was obtained from all participants**.** It includes 60 patient divided in to Conventional & Nerve locator groups.

Conventional Group(C): Patients with supraclavicular brachial plexus block given with conventional paresthesia technique.

Nerve locator Group (NL): Patients with supraclavicular brachial plexus block given with peripheral nerve locator technique

Patients not willing for the procedure, with significant coagulopathies and other contra-indications for supraclavicular brachial plexus block, psychiatric history, allergic to amide local anesthetics, preexisting neurological deficit in upper limb were excluded from the study.

Block was performed with 15 ml of 0.5% bupivacaine and 15 ml of 2% lignocaine with adrenaline 1:2, 00,000 in both the groups. Peripheral intravenous line was accessed using 18G intravenous cannula. All the patients were premedicated with injection glycopyrrolate 8µg/kg intramuscularly (IM) 45 minutes before starting the procedure. Intravenous fluid was started for all patients and was shifted to operating room. Patient was made to lie supine with head turned to opposite side of the intended block, arm adducted and hand extended along the side towards the ipsilateral knee as far as possible. A small pillow or folded sheet was placed below the shoulder to make the field more prominent.

Conventional subclavian perivascular technique

In Group C, block was performed by conventional subclavian perivascular technique by eliciting paresthesia. Each patient was made to lie supine without a pillow, arms at the side, head turned slightly to the opposite side with the shoulder depressed posteriorly downwards by moulding the shoulders over a roll placed between the scapulae. The supraclavicular area was aseptically prepared and draped. The anaesthesiologist stands at the head of the patient to be blocked facing the head of the patient, since this position allows better control of the needle.

An intradermal wheel is raised approximately 1cm above the mid clavicular point. The subclavian artery palpable in the subclavicular fossa. The tip of index finger was rested in supraclavicu lar fossa directly over the arterial pulsation. A filled 10 ml syringe with a 23 gauge, 32 mm nee d le attached was he l d in right hand and patient was instructed to say "now" and not to move as soon as he felt a "tingle " or "electr ic s ho ck like sensation" go ing down his arm. The need le was inserted through skin and advanced s lo w y downward (caudal) rolled slightly inwards (m e d I a ll y) and slightly backward (posteriorly).

After eliciting paresthesia, a 10ml syringe was mounted on the needle and after negative aspiration of blood; 30 ml of local anaesthetic solution was injected. 3-minutes massage was performed to facilitate an even drug distribution. If paresthesia had not been elicited even after 20 minutes, the patients were excluded from the study and given other mode of anaesthesia.

Nerve locator technique

After identifying the lateral insertion of strnocleidomastoid muscular on the clavicle, the operator locates the plexus by palpation, which in adults is found at about 2.5 cm lateral to the strenocleidomastoid. Once the plexus is found, the point of needle insertion is located immediately cephalad to the palpating finger.

The nerve stimulator is connected to the stimulating needle and set to deliver a 0.8 to 1.0mA current at 1Hz frequency and 0.1ms of pulse duration. The needle is inserted first in an anteroposterior direction, almost perpendicularly to the skin with slight caudal orientation.

The needle is slowly advanced until the upper trunk is identified by muscular twitch of the shoulder musculature or up to 1 cm, if there is no response. At this point, the orientation of the needle is changed to advance it now caudally under the palpating finger, with a slight posterior angle, as shown in this strategy directs the needle from the vicinity of the upper trunk (shoulder twitch) to the front of the medial trunk (biceps, triceps, pectoralis twitch) on its way to the lower trunk (finger twitch).

Once the elicited motor response of the fingers is obtained at 0.5mA, the injection is carried out after gentle aspiration. Injecting in the proximity of the lower trunk (motor response of the fingers) is the most important factor in accomplishing a successful supraclavicular brachial plexus block.

As soon as paraesthesia was elicited, the needle was fixed in position and 25ml of the respective drug was injected depending on whether the patient was allotted to The Quality of sensory and motor block was studied and graded as per whether the blocks were complete, incomplete or totally absent.

RESULTS

This study was conducted at Kakatiya medical college, Warangal, undergoing elective surgeries of upperlimb under regional anaesthesia. Approval was taken from the Institutional Ethical Committee before commencing the study. Written and Informed Consent was obtained from all participants**.** It includes 60 patient divided in to Conventional & Nerve locator groups.

Conventional Group(C): Patients with supraclavicular brachial plexus block given with conventional paresthesia technique. Nerve locator Group (NL): Patients with supraclavicular brachial plexus block given with peripheral nerve locator technique.

The study includes patients aged from 15 to 6o years of both sexes. Age wise distribution was shown in table 1. The gender distribution (male: female ratio) in group C was 19:11 while in group NL, it was 11:8. The mean weight of the patient in group NL was 61.32±5.53kilograms and in group C, it was 62.4±8.23 kilograms. Both groups were comparable in terms of age, sex and weight.

Anaesthetic parameters like the mean time taken to perform the block, the mean time for the onset of sensory block, the mean time for onset of motor block, the mean duration of sensory block and the mean duration of sensory block were shown in table 2. Analgesic requirement in both groups were shown in table 3 and overall effectiveness of blocks were shown in table 4. In group C, 21 out of 30 cases had successful block. In group NL, all the 29 cases had successful block. The success rate was significantly higher in nerve locator group. There was no significant difference between groups with regards to pulse, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation.

Table-1: Age wise distribution

Age in years	Group C (No of patients)	Group NL (No of patients)
15-30	11	12
31-45	10	10
46-60	9	8
Total	30	30

Table-2: Comparison of conventional and peripheral nerve locator guided block

Character	Group C	Group NL	Significance
Weight	62.4±8.23	61.32±5.53	Not significant
time taken	5.23±2.13	8.32±3.52	Significant
time for the onset of sensory block	11.29±6.23	7.59±4.35	Significant
time for onset of motor block	13.26±4.25	11.03±4.06	Significant
mean duration of sensory block	5.03±1.36	6.56±1.10	Significant
mean duration of motor block	5.04±1.23	6.32±1.33	Significant

Table-3: Analgesic Supplementation

Study Group	Analgesic Supplementation	
	Required	Not Required
Group C	8	22
Group NL	1	29

Table-4: Overall effectiveness of block

Study Group	Overall effectiveness	
	Totally effective	Partially effective
Group C	21	7
Group NL	29	1

Complication like vessel puncture was observed in 5 among 30 patients in Group C and 1 among 30 patients in Group NL. No other complication was elicited in either of the groups.

DISCUSSION

Brachial plexus block has been proven to be a valuable method of providing anaesthesia for surgery of the forearm and hand. The most common technique is

the supraclavicular approach of brachial plexus because of its ease of performance and increased extent of blockade.

The patients in this study did not vary much with respect to age, sex and weight. Both the groups are comparable. In this study conventional technique is significantly faster to perform than nerve locator technique. This study shows that conventional approach by eliciting paresthesia is technically feasible than nerve locator technique. The time delay in nerve locator guided technique was found to be due to the time spent in identifying and marking the anatomy in nerve stimulator technique when compared to conventional group.

Gajendra Singh *et al*.[6]. Conducted a study between conventional and ultrasound guided and nerve stimulator guided supraclavicular block. They concluded that the mean time taken for an ultrasound guided supraclavicular block was 10.1± 1.15 minutes and for conventional technique it was 5.43± 1.45 minutes. The mean onset of sensory blockade was 10.83 ±2.94 minutes in nerve locator group and 11.60±3.48 minutes in conventional paresthesia group but this slight delay was not statistically significant. The onset of motor blockade was within 14.56±4.49 minutes in ultrasound group and 16.8±3.43 minutes in conventional group with statistical significance. The duration of sensory blockade was significantly prolonged in ultrasound and nerve stimulation group (397.93±7.32 minutes.) when compared to nerve stimulator and conventional group (352.22 ±87.50 minutes).

Veeresham *et al*.[7], in their study to compare ultrasound with conventional technique of supraclavicular brachial plexus block, found that the mean time taken for the procedure was 5.37±1.45 minutes in conventional group whereas, it was 9.97±2.44 minutes in ultrasound group. The onset of sensory blockade was almost similar in both ultrasound (11±2.97 minutes) and conventional techniques (11.27±3.48 minutes). The duration of sensory block was prolonged in nerve stimulation group (444.16±116 minutes) than conventional group (393.2±95.33 minutes).

In a study by Mithun Duncan *et al*.[8] to compare the efficacy of ultrasound guided technique with nerve locator guided method, the time taken in nerve locator is 3.7 and in ultrasound group was 7.27±3.87 minutes which is similar to our study. The onset of sensory block was 5.47 minutes in ultrasound group and 5.90 minutes in nerve stimulator group.

The mean onset time for sensory blockade, onset time for Motor blockage, duration of sensory blockade in our study was inaccodance to other studies [9, 10]. It was evident that there is significantly faster onset of motor block in nerve locator group when compared to conventional group. In our study, the onset of motor blockade in supraclavicular block was found to be delayed than that of sensory blockade in both the groups. These results were similar to other studies [8, 9, 11]. Veeresham *et al*.[7], in their study found that The mean duration of sensory blockade in nerve locator group (NL) was significantly more than conventional group. It is similar to our study.

Thus from this study, it is evident that ultrasound guided supraclavicular block had longer duration of analgesia compared to conventional paresthesia technique. This is in accordance with other studies [8, 10, 12]. The mean duration of motor blockade in group NL was 5.82 ± .83 hours and in group C, it was 5.04±1.08 hours. This is in accordance with other studies [6, 7].

Out of the 30 cases studied under ultrasound group, 29 blocks were complete and 1 block was inadequate with sparing of ulnar nerve segment, none of the patients had failed block. Out of the 30 cases studied under subclavian perivascular approach 21 blocks were complete, 7 were partial and 2 totally failed blocks.

There were no significant differences between the study groups with respect to the pattern of changes in pulse rate, systolic blood pressure, diastolic blood pressure and oxygen saturation perioperatively. Kapral *et al.* [13] compared the efficacy of ultrasound guided technique with nerve stimulator guided supraclavicular block. The above mentioned study results, regarding the hemodynamic variables, were coordinates with our study. Hickey *et al.* [14] conducted a study to define the influence of location of paresthesia in subclavian perivascular block. They have used 30 ml volume for conventional technique. Raizada *et al*.[9] also used 30 ml of local anaesthetic solution for blind subclavian perivascular technique. So, we have decided to take a total volume of 30ml of anaesthetic solution. For comparison purpose, we have used the same volume in conventional subclavian perivascular technique also.

Among the 30 cases in Nerve locator group, only one patient had vascular puncture of subclavian artery which resolved immediately with compression for 15 minutes. Among the 30 patient in conventional group, 4 patients had vascular puncture, in which only one went for hematoma formation which resolved within two days.

Chethananda *et al.* [15] reported the puncture of subclavian vessel in 15 among 66 patients in subclavian perivascular technique without hematoma formation. Raizada *et al.* [9] reported 5 cases of hematoma formation among 60 patients in blind paresthesia technique which resolved in 3-4 days. Winnie and Collins [16] suggested that hematoma is

rare with 22 G Huber point needle. Gajendra singh *et al.* [6] and Veeresham *et al.* [7] also had observed a significant reduction in the incidence of vessel puncture in ultrasound guided technique when compared to conventional paresthesia technique. One rare incidence, massive hemothorax was reported by Shivkumar singh *et al*. [17] and bronchospasm was reported by Rohini Bhat *et al*. [18] following conventional supraclavicular brachial plexus block. Kaufmann *et al*. [19] reported that 7 patients presented with severe nerve injury, established in paresthesia technique.

CONCLUSION

we conclude that, nerve locator guided supraclavicular block for upper limb surgeries when compared to conventional subclavian perivascular technique has a rapid onset of both sensory and motor blockade, prolonged duration of blockade, reduced analgesic requirement both intra- and postoperatively, increased success rate with fewer complications.

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