

ORIGINAL RESEARCH

A comparative study between lateral approach and conventional approach to supraclavicular brachial plexus block in upper limb surgeries

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ABSTRACT

Conventional approach to supraclavicular brachial plexus block is wrought with known technical setbacks due to close proximity of nerves, vessels, and lungs. A novel method, namely Lateral approach, away from the said structures to locate the plexus, is sought to be compared to the conventional technique. A prospective, randomized controlled clinical study was undertaken to compare the lateral (group L, n=38) and conventional (group C, n=38) approaches to supraclavicular brachial plexus block in 76 patients posted for upper limb surgeries, belonging to ASA physical status I and II, after obtaining informed written consent. Lateral approach was technically easier to perform but took longer time and more attempts in learning to locate the plexus, whose depth was 2.91 ± 0.19 cm, (1.54 ± 0.22 in group C). Block characteristics were similar in both the groups. There were no complications with group L but with Conventional approach, two cases of blood vessel puncture were encountered. Lateral approach to supraclavicular brachial plexus block is a novel, easier and safer technique than Conventional technique and practicable even without availability of USG and nerve stimulator.

Key words: Supraclavicular block, upper limb surgeries, brachial plexus block

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INTRODUCTION

Brachial plexus block is one of the most commonly utilized techniques of regional anaesthesia for surgeries involving upper limb. Commonly supraclavicular approach is used. The trunks and cords are bundled closely together at the site of injection. This results in sensory and motor blockade of all nerves of the brachial plexus. The block is appropriate for surgeries of the arm, elbow, forearm and radial aspect of the hand. Supraclavicular approach is based on classical technique or subclavian perivascular entry or interscalene groove. The needle tip is in the same plane as the plexus after traversing a short distance.¹ Each of these methods is beset with technical problems such as arterial puncture, lung/pleural injury, etc. Many complications like pneumothorax, vessel puncture, technical difficulties or even failures are observed in a brachial block. So, for better outcomes of a brachial plexus block, in recent years nerve stimulator technique and ultrasound guidance methods are used.

For many centres without these facilities, landmark technique is still the option. The reason for the abovesaid complications, is the proximity of vital structures at the root of the neck and the line of needle approach which aligns with their general course. Hence, needle entry from a more lateral landmark may be safer. A novel approach to brachial plexus has been described, which seeks to locate the plexus from lateral side parallel to clavicle and hence away from the vessels or pleura.² The needle traverses slightly longer distance in the same plane as plexus. Many studies conclude that supraclavicular brachial plexus block by lateral approach is safe and effective with higher success rate and with minimal complications³⁻⁶. In our institution commonly conventional supraclavicular approach by landmark technique is followed for various upper limb surgeries. We intend to compare this technique with feasibility of the lateral technique.

METHODOLOGY

A prospective, randomized controlled study was done after obtaining the approval of institutional ethics

committee to compare the lateral approach and conventional approach to Supraclavicular brachial plexus block for upper limb surgeries in the Department of Anesthesiology, Pain and Critical Care. A total of 76 patients were enrolled for the study with the following inclusion and exclusion criteria.

INCLUSION CRITERIA

1. Patients willing to give written informed consent.
2. Age: 18-65years.
3. Gender: Male and Female.
4. ASA grade I and II.
5. All patients posted for surgeries of midarm, elbow, forearm and hands

EXCLUSION CRITERIA

1. Patient refusal for the procedure.
2. ASA grade III and IV.
3. Bleeding disorders or patient on anticoagulant therapy.
4. Local infection at the site of block.
5. Neurological deficits involving brachial plexus.
6. Allergy to local anaesthetic.

METHOD

Informed consent was obtained from all patients. Detailed pre-anaesthetic evaluation was done. Demographic (age, gender), morphological (height, weight) and vital parameters were recorded. Patients fulfilling the essential criteria were selected. The patients were randomly divided into 2 groups of (n= 38 in L group, n=38 in C group) patients each using a computer generated randomization table.

The patients were monitored regularly throughout the study and in recovery room for heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, baseline ECG and oxygen saturation.

After establishing intravenous access using 18G IV cannula, an infusion of Ringer lactate was started.

All the patients received supraclavicular brachial plexus block in supine position with arms adducted and head turned to opposite side. Under strict aseptic precautions, the injection site was identified. In group C, Conventional approach was employed. Needle was

inserted 1 cm superior to the midpoint of the clavicle after raising a local wheal by 1% plain Lignocaine. Subclavian artery if palpable, can be used as additional medial landmark. In group L (Lateral approach), local wheal by 1% plain Lignocaine was raised and block needle was introduced just above the clavicle medial to the inner border of trapezius muscle and directed parallel to clavicle beneath the inferior belly of omohyoid muscle.

In both approaches, after eliciting paraesthesia and confirming negative aspiration of blood/air, patients were slowly administered local anesthetic mixture (10ml of Inj 2% Lignocaine with Adrenaline & 10ml of Inj 0.5% Bupivacaine), while carefully ruling out intravascular injection. Successful sensory block was confirmed by assessing along the distribution of following nerves by pinprick: Radial nerve-lateral side of dorsum of hand, Median nerve-thenar eminence, ulnar nerve-5th finger, Musculocutaneous nerve- lateral side of forearm. Successful motor block was confirmed by assessing thumb abduction (Radial nerve), flexion of elbow (Musculocutaneous nerve), thumb opposition (Median nerve), thumb adduction (Ulnar nerve) and also overall ability to lift up the upper limb against gravity after the block. Subsequent to establishment of the block, patients were subjected to the intended surgery. All patients were administered IV midazolam 0.05mg/kg after establishment of block.

Patients complaining of pain at surgical incision were given supplementary analgesics (Fentanyl/pentazocine) for rescue. It was considered as failure if there was no sensory or motor block till 30 minutes of injection and was converted to GA. All the resuscitation equipments including defibrillator and Lipid emulsion (Intralipid 20%) were kept ready.

RESULTS

In 25 patients of group L and 27 patients of group C, the plexus could be located in single attempt. More than one attempt were required in 13 patients in group L and 11 patients in group C respectively.

Table 1: Number of Attempts to Elicit Paresthesia

No. of Attempts	Group L		Group C		p value
	N	%	N	%	
1	25	65.8%	27	71.1%	0.622
>1	13	34.2%	11	28.9%	
Total	38	100.0%	38	100.0%	

Due to short neck, obesity, etc.

In Group L, 2 difficult cases due to short neck were

encountered.

Table 2: Distribution of Technical Difficulty

Technical difficulty	Group L		Group C		p value
	N	%	N	%	
	2	5.3%	0	0.0%	0.152

The mean depth of needle insertion in group L was 2.91±0.19 cm, whereas it was 1.54±0.22 cm in group C. Results are not significant

Table 3: Needle Depth Required for Paresthesia

Parameters	Group L	Group C	t value	p value
Depth in cms ± SD	2.91±0.19	1.54±0.22	28.076	<0.001*

Note: *significant at 5% level of significance (p<0.05).

In Group L mean onset of sensory blockade of 1.92±0.94 mins was observed. In Group C it was 1.92±0.94 mins.

Table 4: Onset of Sensory Blockade

Parameter	Group L	Group C	t value	p value
Onset of Sensory Block (Min) ± SD	1.92±0.94	2.17±0.86	-1.194	0.236

Mean onset of motor blockade was 5.06±1.69 mins in group L. It was 4.97±1.64 mins in group C.

Table 1: Onset of Motor Blockade

Parameter	Group L	Group C	t value	p value
Onset of Motor Block (Min)	5.06±1.69	4.97±1.64	0.213	0.832

Mean duration of analgesia was observed to be 288.61±45.93 mins in Group L and 290.57±44.39 mins in Group C.

Table 6: Duration of Analgesia (in minutes)

Parameter	Group L	Group C	t value	p value
Duration of Analgesia (Min) ± SD	288.61±45.93	290.57±44.39	-0.183	0.855

Rescue analgesia was provided with Inj. Pentazocine 30mg IV for 17 patients in group L and 10 patients in group C.

Table 7: Rescue Analgesia

Rescue Analgesia	Group L		Group C		p value
	N	%	N	%	
	17	44.7%	10	26.3%	0.243

In group L, there were 2 cases (Grade 1) who needed conversion to GA; 17 cases (Grade2) who required supplementation with rescue analgesics and 19 cases (Grade 3) who had excellent block. In group C, there were 3 Grade-1 cases, 10 Grade 2 cases and 25 Grade-3 cases.

Table 8: Comparison of Quality of Analgesia

Quality of Analgesia	Group L		Group C		p value
	N	%	N	%	
Grade1	2	5.3%	3	7.9%	0.243
Grade2	17	44.7%	10	26.3%	
Grade3	19	50.0%	25	65.8%	
Total	38	100.0%	38	100.0%	

In group L, there were no complications. 7.9% of patients in group C had vessel puncture, which were clinically insignificant and were managed with local pressure.

Table 9: Complications

Complications	Group L		Group C		p value
	N	%	N	%	
Vessel puncture	0	0.0%	3	7.9%	0.077

DISCUSSION

In the Conventional approach (Group C) the distance traversed by locating needle for paresthesia or Nerve stimulator technique is quite short, about 2 to 4 cm in

depth. However, this path is close to pleura, lung and blood vessels.

In Lateral approach (Group L), the locating needle is introduced above and parallel to clavicle from medial border of trapezius, beneath inferior belly of Omohyoid, which is hence a longer path to reach the plexus but away from major vessels and pleura, since the needle direction is lateral to medial. Being a new technique the time required to locate the plexus by this approach may be longer for the beginners compared to classical approach, but once the skill is acquired, this approach seems preferred over the classical. Vadhelet *et al.*⁶ also observed that the longer path of the needle allows better leverage in locating the plexus than in classical technique.

In our study the mean depth of insertion to locate the plexus was 2.91 ± 0.19 cm in group L and 1.54 ± 0.22 cm in group C; the time required to elicit paresthesia was 1.69 ± 0.92 mins (Group L) and 1.31 ± 0.17 mins (Group C). The plexus could be reached in single attempt in 65.8% (group L) and 71.1% (group C).

Vadhelet *et al.*⁶ in their study noticed a mean depth of 3.84 ± 0.49 cm in group L and 2.42 ± 0.37 cm in group C. Their block execution time was 5.92 ± 0.56 mins in group L and 4.74 ± 0.89 mins in group C. Also, they noticed that in 73.33% (Group L) and 40% (Group C), single attempt was sufficient to locate the plexus, the rest of the patients needing multiple attempts. They concluded that lateral approach is easier but takes longer time to execute. In a similar comparative study by Prasad *et al.*⁵ time taken to elicit paresthesia was 8.92 ± 2.64 mins in group L and 5.45 ± 1.25 mins in group C. They conducted this study with peripheral nerve stimulator and concluded that lateral approach is better alternative to conventional approach.

Tyler *et al.*⁷ conducted a study of classical supraclavicular block using nerve stimulator on obese patients (with BMI > 30kg/m², 455 patients) comparing with non-obese patients (1565 patients) and obtained overall successful block in 94.3% in the obese and 97% in non-obese with no difference in acute complications. They concluded that obesity is associated with only a slight decrease in success rate of supraclavicular block and an increase in its relative difficulty without apparent effects on acute complication. We encountered 2 cases of short neck (group L) who did not pose difficulty in seeking paresthesia by lateral approach. We hold the view that when nerve stimulator or USG is not available, lateral approach can be a useful alternative in obese subjects.

There were no clinically significant hemodynamic (heart rate, blood pressure, respiratory rate and oxygen saturation) changes noted in our study. Similar observations were noted in the studies of Venkateshet *et al.*⁸, Mustafa *et al.*⁹.

Regarding block characteristics (onset and duration of sensory and motor block) no difference can be expected between the two approaches, since the deposition of local anesthetics by both approaches is aimed to the same destination in supraclavicular fossa.

In line with this assumption we found in our study that onset of sensory block and motor block was 1.92 ± 0.94 minutes and 5.06 ± 1.69 minutes (Group L) and 2.17 ± 0.86 minutes and 4.97 ± 1.64 minutes (Group C) respectively.

The onset time of sensory block by Lateral approach was 3 mins (Kothari *et al.*² and 7.61 ± 2.82 mins (Sahuet *et al.*³). Onset time of motor block took 8 mins (Kothari *et al.*²) and 11.70 ± 2.50 mins (Sahuet *et al.*³). Prasad *et al.*⁵, who compared Lateral approach to Conventional approach did not find difference in the time of onset of sensory or motor block between 2 routes, which ranged from 7.5 ± 0.85 mins to 11.98 ± 2.34 mins (sensory) and 11.85 ± 1.62 mins to 13.15 ± 2.63 mins (motor).

Duration of analgesia in our study by both approaches was about 5 hours (288.61 ± 45.93 mins in group L and 290.57 ± 44.39 mins in group C). Other studies also have not shown difference in duration of analgesia in both the approaches. Vadhelet *et al.*⁶ recorded analgesia for a duration of about 7 hours. Kumar J *et al.*¹⁰ observed analgesia upto 12 hours, Prasad *et al.*⁵ observed analgesia upto 3.75 hrs.

Dilip Kothari² using Lateral approach recorded excellent analgesia in 88%. Kumar J *et al.*¹⁰ recorded 73% excellent block by Lateral approach and 56% by Conventional approach. Prasad *et al.*⁵ noticed 88% excellent block by Lateral approach and 64% by Conventional approach. However, in the series by Vadhelet *et al.*⁶, the results were similar with either approach (68%-Lateral, 69%-Conventional). The above workers concluded that the lateral technique has higher success rate and hence preferred over Conventional technique. In our study, excellent analgesia was seen in 50% in group L and 65.8% in group C. 44.7% in group L and 26.3% in group C required supplementation with analgesics and sedatives (Inj. Pentazocine 30 mg and Inj. Midazolam 1mg). This difference is probably due to the inexperience and novelty associated with the lateral technique.

Grave complications due to brachial block have been reported in literature. Collectively in the lateral approach studies from Dilip Kothari *et al.*², Sahuet *et al.*³, Kumar A⁴ *et al.*⁴, Prasad *et al.*⁵, Kumar J *et al.*¹⁰ and Vadhelet *et al.*⁶, blood vessel puncture (6% to 15%), hematoma (0.5%) and discomfort (1%), PONV (12%) were recorded. The complications in conventional approach adopted by, Kumar A *et al.*⁴, Prasad *et al.*⁵, Kumar J *et al.*¹⁰ and Vadhelet *et al.*⁶ were blood vessel puncture (3% to 24%), Horner's syndrome (4% to 6%), phrenic nerve palsy (3.33%), hematoma (6%) and PONV (20%).

All the studies have documented higher rate of complications with Conventional approach and have reported safer outcome with Lateral route. Our findings also concur with these findings. In our series, we came across only 2 cases of inadvertent vessel puncture in Conventional approach and none in Lateral approach.

These 2 cases also did not deteriorate beyond hematoma formation and subdued by pressure. There were no other complications.

CONCLUSION

A novel method namely Lateral approach to supraclavicular brachial plexus block was compared with conventional approach for upper limb surgeries and it is concluded that:

- Lateral approach is technically easier to perform and traverses a safer path away from vessels and pleura/lungs.
- The depth of needle insertion is longer in Lateral approach.
- Onset and duration of both sensory and motor block are similar in both approaches.
- Lateral approach is practicable even without Nerve stimulator or USG.
- No local complications occurred with Lateral approach.

Being a novel technique, a beginner may take more attempts to locate by lateral approach as also more patients may need supplementation as a part of learning curve.

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