Original Research Article

Comparative study of lateral approach and subclavian perivascular approach of supraclavicular brachial plexus block using the peripheral nerve stimulators

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Abstract

Introduction: Supraclavicular Brachial plexus block is commonly used for upper limb surgeries. Supraclavicular block described as spinal of the arm because of the dense motor and sensory blocked below mid humerus. Advantages of the supraclavicular block are potent intraoperative and postoperative analgesia, reduction in stress response, reduction in opioid requirements and general anesthesia-related side effects.

The Aim of the study: To evaluate the success rate as well as the quality of blockade and clinical efficacy of the Lateral approach compared with the Subclavian Perivascular approach of brachial plexus block for upper limb surgeries and both approach guided by peripheral nerve stimulators**.**

Materials and methods: Sixty patients of ASA grade I and II of either sex undergoing upper limb surgeries were randomly allocated into two groups I and II. Each group comprises of 30 patients. Surgery was done under the Lateral approach of Brachial plexus Block in group I and under the subclavian perivascular approach of Brachial plexus block in group II.

Results: Time to perform the block was shorter, Number of attempts was less and complications were less by the Lateral approach when compared to subclavian Perivascular approach.

Conclusion: Supraclavicular block of brachial plexus by Lateral approach provides an adequate sensory blockade and motor blockade, with less time to perform block and reduced number of

attempts and good tourniquet tolerance, and high success rate and fewer complications when compared to subclavian perivascular approach.

Key words

Supraclavicular Brachial Plexus Block, Lateral Approach, Subclavian Perivascular Approach.

Introduction

Supraclavicular Brachial plexus block (SCB) is commonly used for upper limb surgeries. Supraclavicular block described as spinal of the arm because of the dense motor and sensory blocked below mid humerus [1]. Advantages of the supraclavicular block are potent intraoperative and postoperative analgesia, reduction in stress response, reduction in opioid requirements and general anesthesia-related side effects. Pain relief with SCB is devoid of side effects such as somnolence, nausea, vomiting, hemodynamic instability and voiding difficulties inherent to general and central neuraxial anesthesia [2]. Patient who undergoes surgery under SCB can bypass recovery room and be expeditiously discharged following outpatient surgery. High degree of patient and surgeon satisfaction results because of superior pain control with a minimal side effect. In 1911 Kullenkampff introduced the classic supraclavicular approach of brachial plexus block [3]. Winnie and Collins introduced the subclavian perivascular approach to brachial plexus block. Moorthy introduced the modified Lateral paravascular approach of the supraclavicular block. In recent year Lateral approach technique has been reintroduced, due in large part to an increased understanding of neural plasticity and the possibility of minimizing hospital stay by effective use of supraclavicular block using USG guidance [4]. Until recently, elicitation of paraesthesia has been a classical method to locate nerves for peripheral nerve blocks. Peripheral nerve stimulator technology utilizes objective endpoints for nerve localization and does not depend on patient's cooperation for effective nerve localization [5]. An effective use of PNS technology mandates knowledge of anatomy with respect to optimal needle insertion site to achieve needle tip – target nerve contact muscle innervations scheme of the targeted nerve to identify desire evoked motor response (EMR) [6]. This study attempts to compare the clinical efficacy of supraclavicular block by Lateral and Subclavian Perivascular approach of brachial plexus block by using the peripheral nerve stimulators [7].

Materials and methods

This was a prospective randomized control study conducted at Government Rotapettah Hospital attached to Kilpauk Medical College, Chennai. Sixty patients of ASA I and II of either sex undergoing upper limb surgeries (mostly orthopedic, plastic surgeries) were randomly allocated into two groups I and II. Each group comprises of 30 patients. Surgery was done under the Lateral approach of Brachial plexus Block in group I and under the subclavian perivascular approach of Brachial plexus block in group II. Parameters observed were – block performance time, number attempts, the onset of sensory and motor blockade, tourniquet tolerance and its quality, duration of sensory and motor blockade, success rate, and block related complications like pneumothorax, vessel puncture.

Procedure

After ethical committee approval informed consent was obtained from the patients. Intravenous access was secured. Anesthesia machine checked resuscitative equipment and drugs were kept ready.

Inclusion criteria

- Age > 18 years, both sex.
- ASA I and II
- Undergoing surgery for both elective/ emergency Hand, Wrist, Forearm, elbow and lower arm.

Exclusion criteria

- Age < 18 years, Pregnancy.
- Infection at the puncture site, Coagulopathy.
- Allergy to amide local anesthetics, Psychiatric illness.

Group I and II – 15 ml of 2 % lignocaine with 15 ml of 0.5% bupivacaine and 5 mic/ ml of adrenaline.

Technique

Group – I: Lateral approach

The patient was in supine with head turned to opposite side and arm pulled down gently, A small pillow or folded sheet was placed below the shoulder at interscapular area to make the field more prominent.

The insertion point for Lateral approach is 1 cm above the clavicle at the junction of inner two-third and outer one-third of the clavicle. This point is about 1 cm medial to border of trapezius muscle. The path is behind the omohyoid muscle and parallel to clavicle in the interscalene plane between anterior scalene and medial scalene muscle. The omohyoid muscle can be identified by rolling the index finger in the posterior triangle of the neck in normal built patients, though it is not obvious in all cases. After skin disinfection and sterile covering, an intradermal wheal was raised with 1% lignocaine at the entry point, with anesthesiologist standing at the head end, slightly toward same side, Stimulation cannula was inserted through directed medially and towards the plane of the interscalene space at an angle of 20^0 to the skin, parallel to clavicle deep to the external jugular vein. Contraction of the forearm muscles or biceps was obtained at an electrical intensity of 0.4-0.6mA,(forearm flexion, extension, wrist flexion and thumb adduction). If stimulation does not appear and rib is contacted, the needle is walked off anteriorly. Once the nerve plexus is located, an assistant administered a mixture of 15 ml lignocaine 2% and 15 ml of bupivacaine 0.5% with adrenaline 150µgm slowly after negative aspiration, all the patients had pressure paraesthesia during drug deposition. A gentle pressure at the area was given to make uniform spread. All the patients were given inj. Midazolam 1mg and inj. Pentazocine 30mg slow IV for sedation after successful block.

Group – II: Subclavian perivascular technique

Patient is placed in a supine position with the head turned to opposite side from the side to be blocked. The arm is pushed down to depress the clavicle. The posterior border of sternocledomastoid is felt, by asking the patient to raise the head while keeping the head turned to opposite side. The interscalene groove should be located behind the midpoint of the posterior border of the muscle. The anterior and middle scalene can be make prominent by asking the patient to inspire vigorously. Approximately 1cm above the midpoint of the clavicle the pulsation of the Subcalavian artery can be felt in the interscalene groove. Stand to the side of the patient. On the right side interscalene groove is palpated with the left index finger and the needle is inserted with the right hand. After aseptic measures and intradermal weal, a short beveled 4 cm needle is inserted in the marked point. Subclavian artery is guarded with thumb; the needle is directed caudally, posteriorly and slightly medially. Needle enters the fascial sheath 1-2 cm deep to the skin approximately. Nerve block were performed by using a nerve stimulator (stimulation frequency was 2 Hz stimulation intensity was decreased to 0.4- 06 mA after each muscular twitch (forearm flexion, extension, wrist flexion and thumb adduction). The needle is held firmly and then the local anaesthetic solution is injected after careful aspiration to exclude intravascular placement.

Using this software range, frequencies, percentages, means, standard deviations, chi-square and 'p' values were calculated. Kruskal Wallis chi-square test was used to test the significance of the difference between quantitative variables and Yate’s chi-square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

Results

This study comprised of two groups. **Group – I:** 30 patients were received Lateral approach of supraclavicular brachial plexus block. **Group – II:** 30 patients were received a Subclavian Perivascular approach.

By statistical analysis of the two groups (Lateral and Subclavian Perivascular) the age distribution (p 0.5), sex distribution (p-0.0159), weight (p-0.1693), and ASA physical status (P-0.335) were not statistically significant with p value more than 0.05. Both groups were same onset of sensory blockade, motor blockade, and duration of sensory and motor blockade. No significant difference was observed with respect to pulse rate, systolic and diastolic BP and Saturation.

A number of attempts in the group – I Lateral approach range from 1 to 3 attempts mean value of 1.4 and standard deviation of 0.62.Group – II. Perivascular approach range from 1 to 4 attempts mean value of 2.33 and standard deviation of 0.71.The difference was statistically significant (p = 0.0001) as per **Table - 1**.

Table – 1: Number of attempts.

Number of attempts	**Lateral approach group**		**Perivascular approach**	
	No	**%**	**No**	**%**
1	20	66.7	2	6.7
2	8	26.7	18	60
3	2	6.7	8	26.7
4	-	-	2	6.7
Total	30	100	30	100
Range	1 – 3		1 – 4	
Mean	1.4		2.33	
SD	0.62		0.71	
‘p’	0.0001 Significant			

Table – 2: Time to perform block.

Parameter	**Time to perform block (in minutes)**	
	Lateral approach group	**Perivascular approach**
Range	2 – 5	3 – 6
Mean	2.9	4.7
SD	0.84	0.92
‘p’	0.0001 Significant	

Table – 3: Success of Procedure.

Success of procedure	**Lateral approach group**		**Perivascular approach**	
	No	**%**	**No**	**%**
Complete	28	93.3	21	70
Partial	2	6.7	9	30
‘p’	0.0453 Significant			

Time to perform block in the group – I Lateral approach range from minimum 2 minutes to maximum 5 minutes with a mean of 2.9 and standard deviation of 0.84.Group – II subclavian perivascular approach range from 3 minutes to maximum 6 minutes with the mean of 4.7 and standard deviation of 0.92.The difference was

statistically significant (p = 0.0001) as per **Table - 2**.

The procedure was more successful in the Lateral approach group nearly about 93.3% compared with 70% of the subclavian perivascular approach group. The difference was statistically significant (p = 0.0453) as per **Table - 3**.

No complications in the Lateral approach group – I and 7 cases of complications like vessel injury in subclavian perivascular approach. This difference was statistically significant (p = 0.0053) as per **Table - 4**.

Tourniquet tolerance in Group – I Lateral approach was good in 29 patients with 96.7% success rate, whereas Group – II Tourniquet tolerance was good in 23 patients with 76.7% success rate and fair in 7 patients with 23.3%. The difference was significant (p = 0.0262) as per **Table - 5**.

Table – 4: Complications.

Complications (Vessel injury and pneumothrax)	**Lateral approach group**		**Perivascular approach**	
	No	**%**	**No**	**%**
yes	-	-	7	23.3
No	30	100	23	76.7
'p'	0.0053 Significant			

Table – 5: Tourniquet tolerance.

Tourniquet tolerance	**Lateral approach group**		**Perivascular approach**	
	No	**%**	**No**	**%**
Good	29	96.7	23	76.7
Fair	1	3.3	7	23.3
'p'	0.0262 Significant			

Discussion

Supraclavicular Brachial plexus block, like other regional anesthetics, offers a specific advantage to the patients, surgeon, anesthesiologist, and surgical facility. The anesthesia is limited to a restricted portion of the body on which the surgery will be performed, leaving the other vital centers unaffected. It is possible and desirable for the patient to remain ambulatory [8]. The use of brachial block may minimize the development of central nervous system hyperexcitability during a surgical procedure carried out during general anesthesia [9]. Brachial plexus block eliminates the potential general anesthetic drugs of exposure, respiratory depression, or airway obstruction. Patients who present for surgery with an upper extremity at risk of vascular compromise may improve as soon as pain has been relieved and vasodilatation has been produced by the block [10].

By statistical analysis of two groups [11], Time to perform block in the group –I Lateral approach range from minimum 2 minutes to maximum 5 minutes with a mean of 2.9 and standard deviation of 0.84, Group –II Subclavian perivascular approach range from 3 minutes to maximum 6 minutes with the mean of 4.7 and standard deviation of 0.92. The difference was statistically significant (p = 0.0001) [12].

The number of attempts in the group – I Lateral approach range from 1 to 3 attempts means value of 1.4 and standard deviation of 0.62.Group –II. Perivascular approach range from 1 to 4 attempts mean value of 2.33 and standard deviation of 0.71.The difference was statistically significant (p = 0.0001).

The procedure was more successful in the Lateral approach group nearly about 93.3% compared with 70% of the subclavian perivascular approach group. The difference was statistically

significant (p = 0.0453). Tourniquet tolerance in Group – I Lateral approach was good in 29 patients with 96.7% success rate, whereas Group – II Tourniquet tolerance was good in 23 patients with 76.7% success rate and fair in 7 patients with 23.3%. The difference was significant (p = 0.0262).

No complications in the Lateral approach group compared to 7 cases of vessel injury in subclavian perivascular approach. This difference was statistically significant (p = 0.0053) [14, 15].

Conclusion

Supraclavicular brachial plexus block by Lateral approach when compared to the Subclavian perivascular approach has the advantages of less time to perform the block, reduced number of attempts, high success rate and less complications.

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