DOI: 10.14260/jemds/2014/3103

ORIGINAL ARTICLE

COMPARISON OF LATERAL APPROACH WITH CONVENTIONAL APPROACH OF SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A PROSPECTIVE RANDOMIZED COMPARATIVE STUDY

Pothula Krishna Prasad[1], B. Sowbhagya Lakshmi[2], Paleti Sophia[3], Vanapalli Sirisha[4]

HOW TO CITE THIS ARTICLE:
Pothula Krishna Prasad, B. Sowbhagya Lakshmi, Paleti Sophia, Vanapalli Sirisha. "Comparison of Lateral Approach with Conventional Approach of Supraclavicular Brachial Plexus Block: A Prospective Randomized Comparative Study". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 31, July 31; Page: 8661-8669, DOI: 10.14260/jemds/2014/3103

ABSTRACT: Traditionally Supraclavicular Brachial plexus block is the commonly performed block for upper extremity surgeries. The Problems associated with this technique include inadequate block, failed block, direct injury to the nerves, pneumothorax, phrenic nerve palsy and vascular puncture etc. Recently lateral approach for supraclavicular brachial plexus block is gaining popularity because of its less complications and high success rate. The aim of the study is to compare the efficacy of lateral approach with conventional approach for supraclavicular brachial plexus block. **METHODS:** Fifty patients of ASA grade I and II scheduled for upper extremity surgery (below the midarm) were randomly allocated into two groups of 25 each. Group C was randomly allocated to receive supraclavicular brachial plexus block by conventional approach. Group L was randomly allocated to receive supraclavicular brachial plexus by lateral approach. Both the groups were given 10ml of 1.5% lignocaine and 15ml of 0.5% ropivacaine (total volume 25 ml).The parameters assessed were the onset and duration of sensory and motor blockade, time taken for the procedure, need for supplementation of anaesthesia, adverse effects, tourniquet tolerance and success rate. Statistical analysis was done using appropriate tests, ($p<0.05$) was considered statistically significant. We concluded that lateral approach for supraclavicular brachial plexus block using peripheral nerve stimulator, is a better alternative to conventional approach in terms of higher success rate and lesser complication rate.

KEYWORDS: Brachial plexus block, Lateral approach supraclavicular brachial plexus block, Nerve stimulator, Lignocaine, Ropivacaine.

INTRODUCTION: Brachial plexus block is a popular technique for upper limb surgeries, postoperative and chronic pain management.[1] Supraclavicular brachial plexus block is the common approach used for upper limb surgeries below the mid humerus.[2] The major advantage of supraclavicular block is that, the nerves are tightly packed in this area giving a very fast and deep block. Hence it is called as "The Spinal of the Arm".[3]

However this approach has its own complications like direct injury to the nerves, puncture of subclavian artery, pneumothorax etc.[4] Recently lateral approach for supraclavicular brachial plexus block has gained popularity because of its low side effect profile and higher success rate compared to conventional approach.[5] Dr. Dilip Kothari has described this lateral approach for supraclavicular brachial plexus block and demonstrated that it was associated with minimal complications and high success rate.

Ultrasound guided nerve blocks are being routinely done now a days,[6] however due to unavailability of ultrasound in our operating rooms, the present study was carried out using a nerve

DOI: 10.14260/jemds/2014/3103

stimulator guided technique.[7,8] The aim of our study was to compare lateral approach with conventional approach for supraclavicular brachial plexus block, in terms of characteristics of sensory and motor blockade, success rate and complications.

METHODOLOGY: This prospective randomized comparative study was conducted after approval from local ethical committee and written informed consent from the patients. Fifty adult patients of ASA grade I and II of either gender between 18 to 45years undergoing elective upper extremity surgeries under brachial plexus block were enrolled for the study.

Patients who refused for the procedure, patients having contraindications for supraclavicular brachial plexus block, patients with pre-existing significant systemic disease, patients with history of psychiatric illness, patients allergic to the study drugs (lignocaine and ropivacaine) were excluded from the study.

Patients were randomly allocated into two groups of Group C and Group L of 25 each. In Group C, patients were given brachial plexus block through conventional approach. In the Group L, patients were given brachial plexus block through lateral approach. Randomization was done using computer generated random number tables.

One observer performed the technique of brachial plexus block, another observer who was unaware of the approach of brachial plexus block and study drugs assessed all the patients immediately after the block, intra operatively and postoperatively.

Baseline parameters, Pulse rate, Non-invasive blood pressure, respiratory rate, S_PO_2 were noted. All patients were pre medicated with glycopyrrolate 0.2mg and midazolam 0.05mg/kg intravenously. All blocks were performed according to standard procedure using a short beveled 22G, 100mm sheathed needle, with a nerve stimulator guided technique (B Braun, Stimuplex, Germany).

Electrical current was initially set at 1 to 1.5mA with a frequency of 2 Hz and pulse duration of 0.1msec. The intensity of current was slowly decreased until contraction of forearm muscles or biceps was obtained at 0.4 to 0.6mA. Once the plexus was located, an assistant administered a mixture of 10ml of 1.5% lignocaine and 15ml of 0.5% ropivacaine slowly after negative aspiration.

In Group C, all patients were given brachial plexus block through conventional approach. Patients were laid supine with head turned to opposite side, arm laid by side of chest, small folded sheet was placed below the shoulder to make the field more prominent, and then block was instituted at a point 1cm above the midpoint of clavicle, where subclavian artery pulsations were felt. Pushing the subclavian artery medially with the help of thumb, the needle was advanced in caudal, medial and downward direction.

Drug was deposited once the plexus was located with nerve stimulator. In Group L, all patients were given brachial plexus block through lateral approach. Patients were laid supine with head turned to opposite side; arm laid by side of chest, a small folded sheet was placed below the shoulder to make the field more prominent. The insertion point for this lateral approach is 1cm above the clavicle, at the junction of inner two third and outer one third of the clavicle, which is approximately 1cm medial to the border of trapezius.

Standing at the head end, the needle was inserted at the entry point at an angle of 20degree to the skin, parallel to the clavicle directing medially, avoiding the external jugular vein. Once the plexus is located, with the help of nerve stimulator, the drug mixture was administered slowly after negative

aspiration. A gentle pressure at the area of drug deposition was given for uniform spread of local anaesthetic in both the groups.

After performing the block, assessments were made for the following parameters – time taken for the procedure, onset and duration of sensory blockade, onset and duration of motor blockade, need for supplementation of anesthesia intra operatively, adverse effects and success rate.

Statistically Analysis: Data was analyzed statistically using Fisher's exact test, student t-test and Chi-square test. Data was represented as mean, standard deviation, absolute numbers and percentage. P value <0.05 was considered statistically significant.

RESULTS: 50 patients were enrolled for this study. All the patients completed the study. Paraesthesia was elicited in all the patients using nerve stimulator.

Demographic variables like Age, weight, gender, ASA grading and mean duration of surgery were comparable between the two groups (P>0.05) (Table-1). The types of surgeries included were plating and fixation of fracture both bones for arm, fixation of fracture lower 1/3rd humerus and fixation of fracture distal radius (Table.2). The mean time taken for the procedure was 5.45±1.25 minutes in Group-C compared to 8.92±2.64 minutes in Group-L [(P<0.001) (Table-3)], statistically highly significant.

The mean times to onset of sensory and motor blockade were comparable in both the groups [(p>0.05) (Table-4)]. The mean duration of sensory and motor blockade also did not differ between the two groups (P>0.05, statistically not significant, Table-5). The mean duration of analgesia also did not differ between the two groups (P>0.05, statistically not significant, Table-5).

68% of patients in Group-C and 88% in Group-L had totally effective and successful blockade [(P<0.05) statistically significant, Table-6]. 32% of patients in Group-C and 12% in Group-L had partial blockade and were supplemented with 0.5mg/kg of intravenous ketamine (Table-6). None of the patients had failed block in this study.

56% of patients in Group-C and 80% of patients in Group-L had good tourniquet tolerance for up to 120 minutes. Later on the tourniquet was deflated and the surgery was continued (Table-6), (P<0.05, statistically significant). 12% of patients in Group-C and 8% in Group-L had mild discomfort few minutes after the application of tourniquet, but they tolerated the surgery without need for supplementation of anaesthesia. 24% in Group-C and 4% in Group-L had vascular puncture while performing the block (P<0.05, statistically significant, Table-7).

No other significant complications like pneumothorax, nerve injury, LA toxicity, intravascular injection of local anaesthetic etc. were observed in this study, except one patient (4%) in Group-C had Horner's syndrome. 20% in Group-C and 12% in Group-L had post-operative nausea and vomiting (P>0.05, not statistically significant, Table-7).

DISCUSSION: Peripheral nerve blocks are always cost effective anaesthetic techniques used to provide excellent quality of anesthesia and analgesia besides avoiding all the consequences of general anaesthesia.[9]

Of the various approaches described for supraclavicular brachial plexus block, conventional approach is popular and is also associated with rapid onset and reliable sensory and motor blockade. Lanz et al, showed that the blockade of the brachial plexus with a technique directed near the first rib

DOI: 10.14260/jemds/2014/3103

i.e. at the level of trunks and divisions of brachial plexus provides the most reliable, uniform and predictable anesthesia for upper extremity.[10]

Inspite of the advantages, fear of complications like pneumothorax, inadequate blockade and rate of conversion to general anesthesia, other complications associated with local anesthetics limits the usefulness of this block..[11] Ultrasound guided techniques provide more predictable blocks with almost nil complications because the local anesthetic is deposited under direct visual guidance of real time ultrasound image.[12]

We performed the block in this study with peripheral nerve stimulator technique (B Braun Stimuplex needle, Germany) because of non-availability of ultrasound facility in our operating room. However, this technique is also not completely fool proof and carries risk of injury to the surrounding structures like vessels, nerves, pleura etc as proved in previous clinical studies.[13]

In our study we performed the lateral approach brachial plexus block using nerve stimulator guided technique. In this lateral approach as the needle passes from lateral to medial side at an angle of 20^{o} to the skin parallel to the clavicle, it will first encounter the brachial plexus eliciting paraesthesia.[14,15]

Paraesthesias were elicited in all the patients of both groups using nerve stimulator guided technique. The observer anesthetist who did intraoperative assessments was blinded to the group allocation. The mean time taken for the procedure was 5.45 minutes in Group-C compared to 8.62 minutes in Group-L ($p<0.001$) which was statistically significant. As it was a novel approach, initially it took more time to perform the block than conventional approach. Later on the technique become more familiar and was performed without any difficulty.

The times to onset of sensory and motor blockades did not differ in both the groups ($p>0.05$, statistically not significant). The mean durations of sensory and motor blockades also did not differ in both the groups ($p>0.05$, statistically not significant). The durations of analgesia also did not differ in both the groups ($p>0.05$, statistically not significant).

There were no significant variations in the intra operative haemodynamics between both the groups.

8(32%) patients in Group-C and 3(12%) patients in group L had inadequate sensory blockade and required supplemental anaesthesia with 0.5mg/kg of intravenous ketamine, though paraesthesias were elicited properly.

6(24%) patients in Group-C and 1(4%) patient in group L had vascular puncture while performing the block. With continuous pressure for 5 minutes the bleeding was stopped in both the groups. Actually we did a pilot study to get familiar with the lateral approach. The incidence of vascular puncture is high in the pilot study but later on as we were acquainted with the technique; the vascular puncture rate is negligible in the original study.

This is statistically significant ($p<0.05$). None of the patients in both the groups had other complications like nerve injury, pneumothorax, local anaesthetic toxicity, phrenic nerve palsy etc. except one patient in conventional approach had Horner's syndrome as complication. The incidence of pneumothorax is almost negligible in lateral approach as the needle is directed parallel to clavicle.

Pham Dang C, Gunst JP et al, observed asymptomatic phrenic nerve paralysis (60%) Horner's syndrome (10%) and transient recurrent nerve paralysis in their study on a novel supraclavicular approach to brachial plexus block.[16] The authors also reported that 93% of cases had effective intra operative anaesthesia. Hempel V, Fink MV et al and Dupre LJ, Danel V et al, also reported Horner's

syndrome as a complication in their studies on supraclavicular block through longitudinal approach.[17,18]

Dr. Dilipkothari assessed the effectiveness of this lateral approach in a series of 250 patients and reported that 88% of patients had complete analgesia within 3 minutes. No other complications were reported in this study except vessel puncture in 6% of cases.[19]

In a prospective, non-randomized, open level study by DK Sahu and Anjana Sahu, 82 patients were evaluated regarding the success rate and complication rate of lateral supraclavicular approach and observed that 92% of patients had successful block with no significant complications in any case.[20]

Nishiyama N, Naqanuma K et al., reported that the success rate of their study was 95%. They did this lateral approach under fluoroscopic guidance.[21] The success rate in our study using landmark technique with the help of nerve stimulator was 88% in lateral approach verses 68% in conventional approach. One patient (4%) in Group C had Horner's syndrome as complication.

The chances of injuring other neural structures like phrenic nerve or stellate ganglion are also negligible in lateral approach.[22] Besides being a safe technique, this approach blocks all the nerves of the plexus with the same frequency because, the trunks and cords are arranged together in such a way that the distance involved in the spread of local anesthetic to the nerves is short and nearly equal.

Tourniquet tolerance was good in 56% in Group-C and 88% in Group-L. 12% in Group-C and 8% in Group-L had mild discomfort after tourniquet application, but they tolerated the surgery well without need for supplementation.

Previous studies reported injection of 30-40 ml of local anesthetic with multiple pricks to produce rapid and effective blocks[23]. In our study we used 25 ml of local anesthetic mixtures of lignocaine and ropivacaine deposited slowly at once which produced reliable and rapid block.

One limitation of our study was unavailability of ultrasound facility to give blocks under fluoroscopic guidance. Recently ultrasounds guided blocks are very popular because they produce predictable blocks with high success rate.

Our study proved that still, we have a place for landmark guided techniques where ultrasound is not feasible in the perioperative areas. The observer anesthetist who performed the blocks was not blinded to the technique (though he was blinded to the study drug) which was a possible source of bias in this study.

A Kumar, B Shadangi et al, reported that lateral approach is a better alternative to conventional approach with high success rate and less complication rate.[24] The observations of this study correlated with our study, the difference being, they did not use peripheral nerve stimulator to perform the block.

Hence we concluded that lateral approach for supraclavicular block is a safer and better alternative to conventional approach.

CONCLUSION: We hypothesize that lateral approach for supraclavicular brachial plexus block using peripheral nerve stimulator guided technique is a better alternative to conventional approach in terms of higher success rate and lesser complication rate. The characteristics of sensory and motor blockade with respect to onset and duration were comparable between both approaches.

REFERENCES:

1. Andrew T. Grey: Ultrasound guidance for regional anaesthesia, Miller's Anaesthesia, Ronald D. Miller, 7th edition 2010; Churchill Livingstone Elsevier; 1675-1686
2. J. Alfred Lee, R.S. Atkinson, G. B. Rushman. A synopsis of anaesthesia, 10th edition 1987; 618.
3. Korbon GA, Carron H, Lander CJ. First rib palpation: A safer, easier technique for supraclavicular brachial plexus block. Anesth Analg 1989; 68: 682-5.
4. Brown DL, Cahill DR, Bridenbaugh LD> Supraclavicular nerve block: Anatomic analysis of a method to prevent pneumothorax. Anesth Analg 1993; 76: 5304.
5. Moore DC. Regional block; A hand book for use in the clinical practice of medicine and surgery; 4th ed spring field 11, Charles C Thomas 1975; 221.
6. Suzanne carty, Barry Nicholls: Ultrasound guided regional anaesthesia, Oxford journals, medicine. Br J Anaesth; CEACCP:; 2007(7) 1:20-24
7. Fanelli G, Casati A, Garancini P, Torri G. Nerve stimulator and multiple injection technique for upper and lower limb blockade: failure rate, patient acceptance and neurologic Complications. Anesth Analg 1999; 88: 847-52.
8. Haleem S, Siddiqui AK, Mowafi HA, Ismail SA, Ali QA. Nerve stimulator evoked motor response predicting a successful supra clavicular Brachial plexus block. Anesth Analg 2010; 110 (6) 1745-6.
9. Kulenkampff D, Persky MA. Brachial plexus anaesthesia: its indications, techniques and dangers. Ann Surg1928; 37: 883-91.
10. Lanz E, Thesis D, Jankovic D. The extent of blockade following various techniques of brachial plexus block. Anesth Analg 1983; 62: 55-8.
11. Brand L, Papper EM. A comparison of supraclavicular and axillary techniques for brachial plexus blocks. Anesthesiology 1961; 22: 226-9.
12. Vincent W S Chan, Anahi Perlas, Regan Rawson. Ultrasound-Guided Supraclavicular Brachial Plexus Block. Anesth Analg 2003; 97: 1514-7.
13. Wildsmith J A W, Armitage E N, McClure J H. Principles and practice of regional anaesthesia, 3 rd edition, 2003:193-203.
14. L A Colvin Mcclure, Anatomy and physiology of pain, In principles and practice of Regional Anaesthesia, J. A. W. Wildsmith, 3rd edition, Churchill Livingstone;2003.
15. Ball HCJ. Brachial plexus block: a modified supraclavicular Approach. Anaesthesia 1962; 17: 269-73.
16. Pham Dang C, Gunst JP, Gouin F, Poirier P, Touchias S, Meunier JE, et al; A novel supraclavicular approach to brachial plexus block. Anesth Analg 1997; 85: 111-6.
17. Hempel V, Van Finck M, Baumgartner E. A longitudinal supraclavicular approach to the brachial plexus for the insertion of plastic cannulas. Anesth Analg1981; 60: 352-5.
18. Dupre LJ, Danel V, Legrand JJ, Seiglitz P. Surface landmarks for supraclavicular block of the brachial plexus. Anesth Analg 1982; 61: 28-31.
19. Kothari D. Supra clavicular brachial plexus block: A new approach. Indian J Anaesth 2003; 47: 287-8.
20. DK Sahu, Anjana Sahu. Lateral approach for supraclavicular brachial plexus block. Indian J Anaesth2010 54; 3: 215-8.

DOI: 10.14260/jemds/2014/3103

21. Nishiyama M, Naqanuma K, Amaki Y. A new approach for brachial plexus block under fluoroscopic guidance. Anesth Analg 1999; 88: 91-7.
22. Dalens B, Vanneuville G, Tanguy A. A new parascalene approach to the brachial plexus in children: Comparison with the supraclavicular approach. Anesth Analg1987; 66: 1264-71.
23. Patrick J. Technique of brachial plexus blocks anaesthesia. Br J Surg 1940; 27: 734.
24. A Kumar, B Shadangi, J Agarwal, V Agnihotri. Lateral Approach Of Supraclavicular Brachial Plexus As A Better Alternative To Conventional Supraclavicular Brachial Plexus block. The Internet Journal of Anaesthesiology.2012 Volume 30 Number 3.

	Group C (n=23)	**Group L (n=25)**	**p value***
Age in years	35.6±9.58	33.82±10.02	0.842
Weight in kgs	58.42±10.15	60.24±8.26	0.725
Gender (M:F)	16:9	18:7	0.495
ASA status I/II	20:5	19:6	0.325
Mean Duration of Surgery	126±15	124±12	0.463

Table 1: Demographic Data

Data expressed as mean (SD) or ratio or absolute numbers
*Fischer's exact test

	Group C (n=23)	**Group L (n=25)**
Plating and fixation of # both bones forearm	17	16
Fixation of #Lower 1/3rd humerus	5	4
Fixation of # distal radius	3	5

Table 2: Types of Surgeries

	Group C (n=25) Mean±SD	**Group L (n=25) Mean±SD**	**p value***
Time in minutes	5.45±1.25	8.92±2.64	<0.001

Table3: Mean time taken for the procedure

student-t-test
SD- Standard Deviation
*Statistically highly significant

	Group C Mean±SD (n=25)	**Group L Mean±SD (n=25)**	**p value***
Sensory Block	7.5±0.85	8.5±1.25	0.395
Motor Block	11.85±1.62	12.94±1.72	0.421

Table 4: Mean time to onset of sensory and motor blockade

SD=Standard Deviation
*Statistically not significant

DOI: 10.14260/jemds/2014/3103

	Group C Mean±SD (n=25)	Group L Mean±SD (n=25)	p value*
Sensory Block	185.50±25.56	192.65±22.54	0.273
Motor Block	172.58±35.82	186.25±25.67	0.125
Analgesia	220.68±15.25	225.52±18.28	0.245

Table 5: Mean duration of sensory and motor blockade

SD=Standard Deviation
*Statistically not significant

	Group C Mean±SD (n=25)	Group L Mean±SD (n=25)	p value
Totally effective	16 (64%)	22 (88%)	0.035*
Partially effective	9 (36%)	3 (12%)	0.041*
Tourniquet tolerance good	14 (56%)	20 (80%)	0.038*
Pain with mild discomfort	2 (8%)	2 (8%)	0.54$^{\perp}$

Table 6: Adequacy of Block

Data expressed as percentage and absolute numbers
*Statistically significant
$^{\perp}$ Statistically not significant

	Group C Mean±SD (n=25)	Group L Mean±SD (n=25)	p value
Vessel puncture	6 (24%)	1 (4%)	0.021*
Pneumothorax	-	-	
Horner's syndrome	1 (4%)	-	0.432
Phrenic nerve palsy	-	-	
Nerve injury	-	-	
LA toxicity	-	-	
PONV	5 (20%)	3 (12%)	0.523

Table 7: Adverse Effects

* Statistically significant
Data expressed as percentage and absolute numbers

DOI: 10.14260/jemds/2014/3103

ORIGINAL ARTICLE

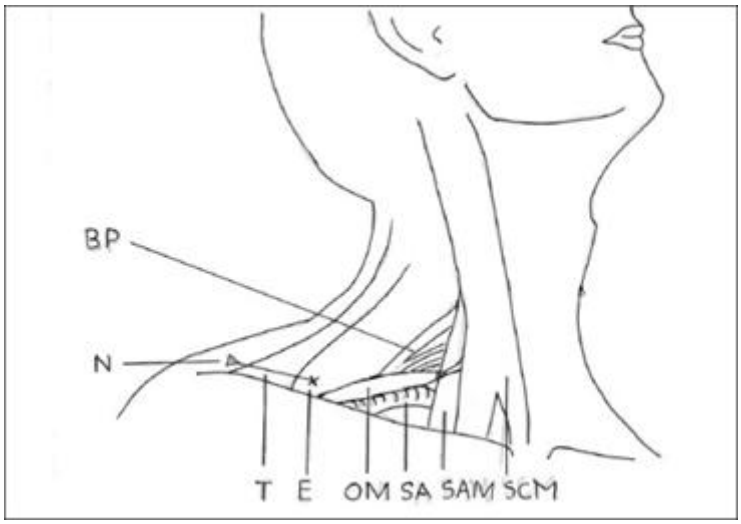

Figure 1

AUTHORS:

1. Pothula Krishna Prasad
2. B. Sowbhagya Lakshmi
3. Paleti Sophia
4. Vanapalli Sirisha

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Anaesthesiology and Critical Care, NTR University of Health Sciences.
2. Professor and HOD, Department of Anaesthesiology and Critical Care, NTR University of Health Sciences.
3. Assistant Professor, Department of Anaesthesiology and Critical Care, NTR University of Health Sciences.
4. Post Graduate, Department of Anaesthesiology and Critical Care, NTR University of Health Sciences.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. P. Krishna Prasad,
H. No. 64-1-4/4,
Pratap Nagar,
Kakinada-533001.
Email: drkp79@gmail.com

Date of Submission: 14/07/2014.
Date of Peer Review: 15/07/2014.
Date of Acceptance: 23/07/2014.
Date of Publishing: 31/07/2014.