Lateral Approach Of Supraclavicular Brachial Plexus As A Better Alternative To Conventional Supraclavicular Brachial Plexus Block

A Kumar, B Shadangi, J Agarwal, V Agnihotri

Citation

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 Anesthesiology. 2012 Volume 30 Number 3.

Abstract

Purpose: Supraclavicular brachial plexus block technique, blocks the entire arm distally till mid arm level but risk of pneumothorax, phrenic nerve palsy and vascular puncture could be life threatening so to overcome these sequale we compared the lateral approach of supraclavicular brachial plexus block with conventional approach of supraclavicular block. Methods: Patients were randomly allocated in two groups; group 1 (n=50) received conventional approach of supraclavicular brachial plexus block and group 2 (n= 50) received lateral approach of supraclavicular brachial plexus block. Both the group received lignocaine with adrenaline (1:200000) 7 mg/kg and bupivacaine 2 mg.kg -1. The total volume of drug injected was 30 ml. Results: All the patients were assessed in terms of Time of onset of analgesia, Extent of sensory block, Quality of motor blocked, Tourniquet tolerance, Technical difficulty, Total duration of analgesia, Total duration of motor paralysis, and complications. Appropriate statistical analysis was done. Conclusion: We concluded that the Lateral Approach of Supraclavicular brachial plexus block justifies its own routine clinical uses because it has got better compliance of block in relation to onset, duration, extent and success rate. It is less traumatic and causes less adverse effects like puncture of vessels and pleura.

INTRODUCTION

Regional nerve blocks facilitate the surgery along with elimination of pain. Brachial plexus block is an accepted technique for upper limb surgeries, ambulatory anesthesia, cancer, postoperative and chronic pain management. Four approaches of brachial plexus blocks are in practice- axillary[1], supraclavicular[2], infraclavicular and interscalene. While axillary, supraclavicular and interscalene have become more popular, their limitation and sequelae have been overlooked and accepted. Supraclavicular technique blocks the entire arm distally till mid arm level, but the risk of pneumothorax, phrenic nerve palsy and vascular puncture could be life threatening. Ultrasound guided nerve blocks are now a routine practice in many parts of the world. However, the availability of an ultrasound in developing countries is limited. In absence of sophisticated tools, clinical landmarks are always useful. We hypothesized that a lateral approach to the brachial plexus could offer some advantage in preventing these complications. The present study of supraclavicular brachial plexus block by a lateral approach was carried out prospectively in a randomized manner. The clinical evaluation of supraclavicular brachial plexus block by lateral approach was performed in terms of the characteristics of sensory block, motor block, sequelae and complications.

MATERIAL AND METHODS

This prospective, randomized and blinded study was carried out after approval from local ethics committee and informed patient consent. Hundred adult patients of ASA grade I and II, of either gender, between the age group of 15-60 years, undergoing routine or emergency surgery for upper limb under brachial plexus block were enrolled for the study. Patients were randomly allocated to one of the two groups. In Group 1, patients received conventional approach of brachial plexus block and in Group 2; patients received lateral approach of brachial plexus block.

All patients with co-existing medical conditions like hypotension, ischemic heart disease, diabetes, severe anemia, renal disease where general anesthesia was supposed to be associated with increased risk, were particular interest. Patients with anatomical distortion, scars, localized infection of upper arm, psychologically unfit

patients, pregnant women, were excluded from this study. Before starting the procedure a baseline pulse rate, blood pressure, respiratory rate and oxygen saturation were recorded.

All patients were kept nil orally for at least 6 hours before procedure and premedicated with intravenous glycopyrrolate 0.2 mg and midazolam 0.05 $mg.kg^{-1}$

GROUP 1: (CONVENTIONAL APPROACH)

Patients were laid supine with head turned to opposite side, shoulder depressed and arm by the side of chest. A small pillow or folded sheet was placed below the shoulder to make the field more prominent. Midpoint of the clavicle where subclavian artery pulsation is felt was marked and the area cleaned and sterilized. The subclavian artery pulsation was shifted slight by thumb of the left hand and the needle was inserted 1 cm above the clavicle, directed backward, inward and downward. Drug was deposited either on first rib or where the paresthesia was elicited.

GROUP 2: (LATERAL APPROACH)

The position of the patients was same as in group 1. A point was marked 1 cm above the junction of medial two third and lateral one third of clavicle. Under all aseptic precautions an intradermal wheal was raised with 2% lignocaine at the selected point with anesthesiologist standing at the head end, slightly towards the side. A 5 cm long 22 G needle was inserted through the wheal, directed medially and inward at the angle of 20 degree to the skin, parallel to the clavicle avoiding the external jugular vein till paresthesia was elicited in the hand. After negative aspiration the drug was administered. The dose of drug used was lignocaine with adrenaline (1:200000) 7 $mg.kg^{-1}$ and bupivacaine 2 $mg.kg^{-1}$. The total volume of drug injected was 30 ml. If according to the weight, the volume was less than 30 ml, it was made up by adding normal saline.

In the event of a vascular puncture in both the group the needle was withdrawn, flushed with normal saline and after applying the pressure over area for 5 min the needle was reinserted. Patients were evaluated for the following parameters, 1) Time of onset of analgesia, 2) Extent of sensory block, 3) Quality of motor blocked, 4) Tourniquet tolerance, 5) Technical difficulty, 6) Total duration of analgesia, 7) Total duration of motor paralysis, and, 8) Complications.

Onset of analgesia was recorded by subjective feeling of loss of pain, heaviness, tingling and numbness after deposition of local anesthetics. Skin was pricked with 25 G needle every 3 min. to test the sensation. The time interval from completion of drug injection to complete loss of sensation (No pain from pin prick) was recorded.

Extent of sensory block was tested by the pinprick method every 5 min. The block was defined by Vester Andersen criteria as, Successful: sensory block of atleast two of the following: radial, ulnar, median and musculocutaneous nerve, Failed: presence of sensation in all nerve or presence of anesthesia in just one nerve[1].

Quality of motor block was assessed every 5 min for first thirty min and graded as follows. Grade 1: ability to flex and extend the forearm, Grade 2: ability to flex and extend wrist and finger, Grade 3: ability to flex only fingers and Grade 4: inability to move forearm, wrist, and finger (self assessed)

Tourniquet tolerance was assessed after tourniquet application as Good: no discomfort of tourniquet, Fair: tightening discomfort and Poor: pain intolerance

Technical difficulty was assessed by the number of times needle required redirection and was categorized – Easy: plexus reached in first attempt and Difficult: needle needs to be redirected more then once.

Total duration of analgesia was recorded in minutes from appearance of 1 st complaint of pain / discomfort by the patient after the onset of a successful block.

Total duration of motor blockade was considered from the onset of successful block to complete recovery of movements of all muscles and joint group i.e. fingers, wrist, elbow and shoulder.

Complications such as bradycardia, hypotension, vascular puncture, hematoma, headache, convulsion, respiratory depression, pneumothorax, phrenic nerve block and diaphragmatic paralysis were looked for.

Data are expressed as mean (SD) or number (%).Statistical analysis was done using software STATA 9.0 (College Station, Texas, USA). Demographics and all data between the two group was compared using Student ‘t’ test. The value of $P < 0.05$ was considered significant.

RESULTS

All patients enrolled completed the study. None were excluded from final analysis. The demographic and block

characteristics are shown in table 1 [Table 1]. Extent of sensory block (success rate) in group 1 was 88% while in group 2 it was 96%. Quality of motor block, percentage of grade 3/ 4 was 46/42 in group 1 while 18/78 in group 2. Tourniquet tolerance in group 1 was 54% while 78% was in group 2. Technically it was easy to perform the block in group 1 but difficult in group 2. The complications noted in the two groups are tabulated. [Table 2]

Table 1

	Group 1 (n=50)	Group 2 (n=50)
Age (years)	31.5 (±10.86)	32.02(±11.04)
Weight (kg)	55.56(±4.66)	57.14(±5.86)
Gender (m:f)	43:7	41:7
Onset of analgesia (min)	11.77(4.07)	7.33(4.17)*
Duration of analgesia (min)	152.8(31.3)	180.8(38.43)*
Duration of motor block (min)	154.2(31.75)	176.57(33.92)*

Data are Mean (SD). n – number of patients; m:f – male:female; min – minutes

* p value less than 0.05

Data are Mean (SD). n – number of patients; m:f – male:female; min – minutes; * p value less than 0.05

Table 2

	Group 1 (n=50)	Group 2 (n=50)
Vascular puncture (n)	6	3
Discomfort/Pain (n)	1	2
Hematoma formation (n)	3	1

n – number of patients

DISCUSSION

In the present study, lateral approach was used with an idea that as the needle passes from lateral to medial side at an angle of 20 degree to skin and parallel to clavicle, it will first meet the brachial plexus nerves eliciting paresthesia. In our study paresthesia could be elicited in 96% cases as compared to 43% in a study by Hampel et al.[2]. As the vessels lie medial to nerves, chances of piercing them are less. Only 6% cases had vessel puncture. In our study the incidence of pneumothorax is nil as compared to Moore described 1.5% incidence of pneumothorax[3].

Ansbro found that following completion of injection the usual length of time to develop analgesia was 15 min[4]. A study by Dang showed that complete block developed within 10 min. in 98% patients[5]. In our series maximum cases showed onset of analgesia; 64% of patients in group 1 between 9.1-18 min. and 70% of patients in group 2, 1.5-9 min. Matsuda showed that 94% cases (47 out of 50) gave surgical anesthesia throughout the operation[6]. In 1997, Dang demonstrated 93% cases (147 out of 150) had effective intraoperative satisfactory anesthesia[1]. In our study, 88% patients in group 1 whereas 96% patients in group 2 showed excellent operative condition. About 42% patients in group 1 and 78% patients in group 2 were unable to move the finger, wrist, and elbow. This is probably due to peripheral deposition of drug.

In our series 54% of patients in group 1 and 78% patients in group 2 had good tourniquet tolerance, suggesting good analgesia of axillary and medial cutaneous nerve of arm[7, 8].

In the present study 48% of the patients in group 2 were found technically assessable. Because of practice it has been observed that as the time passes the operator become more skilled, hence it is easy to perform in expert hands, that is why it is easier as compared to supraclavicular conventional approach. The long and lateral track of needle along with much body mass in supraclavicular region makes the technique somewhat difficult. Nishiyama et al used fluoroscopic guidance for perivascular block and got 95% block without much technical difficulty[9].

In Ansbro study average duration of analgesia was found to be 2 hrs[4]. In our series duration of analgesia is found between 91-180 min in 68% of patient in group 1 while 68% of patients in group 2 were pain free for about 151-240 min.

A limitation of this study could be the non-usage of ultrasound machine for giving the nerve block, which is a routine in many centers of world. Lack of availability of the equipments in most centers of developing countries makes it imperative for clinicians to apply their clinical skills based on anatomical and surface landmarks.

Lateral approach of supraclavicular block is safe as compared to Macintosh approach due to the negligible chances of puncturing the pleura or the other important

neural structures of neck like phrenic nerve or stellate ganglion. In our study no serious sequelae like pleural puncture, pneumothorax or any other cardiorespiratory side effects were observed during the procedure, so as to require active intervention [table 2]. Besides being a safe technique, lateral approach for supraclavicular brachial plexus block offers additional advantage. This approach blocks all the nerves of the plexus with the same frequency because at this level trunks and cords are bundled together and the distance involved in the spread of local anesthetic to the nerve structure is short and nearly equal, while with interscalene there is involvement of caudad nerves of the cervical plexus and cephalad nerves of brachial plexus. The reason for this is that fan like arrangement of trunks within the interscalene space. So local anesthetics rarely reach the roots of T1 and ulnar nerve block may be missed. Also with interscalene approach local anesthetics may spread in epidural or subarachnoid space.

CONCLUSION

Supraclavicular brachial plexus block by lateral approach is a new approach which justifies its own routine clinical uses because it has got better compliance of block in relation to onset, duration, extent and success rate. It is less traumatic and causes less adverse effects like puncture of vessels and pleura. We believe that this technique is more suitable as compared to Macintosh technique.

References

1. Vester AT, Eriksen C, Christiansen C. Perivascular axillary block 3, blocked following 40 ml of .5, 1, or 1.5% mepivacaine with adrenaline. Acta Anaesthesiol Scand 1984; 28:95-8
2. Hampel V, Fink MV, Baumgartner E. A longitudinal supraclavicular approach to the brachial plexus for the insertion of plastic cannula. Anesth Analg 1981;60:352
3. Moore DC, Bridenbaugh LD, Eather KF. Block of upper extremity: supraclavicular versus axillary approach. Arch Surg. 1965;90:68-72
4. Ansbro FP. A method of continuous brachial plexus block. Am J Surg 1946;71:716-712
5. Pham DC. A novel supraclavicular approach of brachial plexus block. Anesth Analg 1997;85:111-116
6. Matsuda M, Kato N, Hosoi M. Continuous brachial plexus block for replanation in the upper extremity. Hand 1982;14:129-34
7. Rodriquez J,Barcena M,Rodriquez V,Aneiros F,Alvarez J. Infraclvicular brachial plexus block effect on respiratory function and extent of block. Reg Anesth Pain Med 1998;23:564-8
8. Ootaki C,Hayashi H,Amano M. USG guided infraclavicular brachial plexus block; an alternative technique to anatomical-guided approaches. Reg Anesth Pain Med 2000;25:600-4.
9. Nishiyama M, Naqanuma K, Amaki Y. A new approach for brachial plexus block under fluoroscopic guidance. Anesth Analg 1999;88:91-7
10. Miller's Anesthesia. Seventh edition, Local anesthetics.927-928
11. Lee's Synopsis of anesthesia. Eleventh edition.923-624

Author Information

Arvind Kumar, MD
Department Of Anaesthesiology, Medanta “The Medicity”

Bijay Kumar Shadangi, MD
Department Of Anaesthesiology, Medanta “The Medicity”

Jitendra Agarwal, MD
Department Of Anaesthesiology, Gajraraja Medical College

Vishwa Mohan Agnihotri, MD
Department Of Anaesthesiology, Gandhi Medical College