Original Research Article

Indian Journal of Anesthesia and Analgesia
January – February 2020; 7(1) (Part -II): 267-271
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7120.36

Comparison between Conventional Technique and Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgeries

JC Makwana[1], Manan Shah[2], Arpit Shah[3]

[1]Associate Professor [2]Senior Resident [3]Junior Resident, Department of Anaesthesia, GMERS Medical College, Sola, Ahmedabad, Gujarat 380060, India.

Abstract

Background: The conventional technique of supraclavicular brachial plexus block often requires multiple trials and error needle attempts, resulting in long procedure time, procedure related pain, discomfort and lethal complication. Ultrasound has improved the success rate of block with excellent localization as well as improved safety rates with lower complication rates. *Objectives:* To compare the effects of supraclavicular brachial plexus block using conventional blind technique and US technique in terms of success rate of technique, number of complications observed, Time taken for the procedure, Onset and duration of sensory and motor blockade, duration of postoperative analgesia. *Materials and Methods:* This was a prospective randomized nonblinded comparative study in which patients of ASA Grade I and II posted for upper limb orthopedic surgeries admitted during Nov 2015 to May 2017 to the Department of Orthopedics, GMERS Medical College, Hospital, Sola, Ahmedabad were enrolled in the study. There were total 100 patients enrolled who satisfies study selection criteria out of which 50 were randomized in Group C (Conventional) and 50 were randomized in Group US (Ultrasound Guided). *Results:* The block was successful in 72% of patients in Group C compared to 94% in Group US. In conventional group incidence of complications like vessel puncture 12%, pneumothorax 2% noted while in US Group vessel puncture 4% noted. Time for procedure for block in Group US is longer as compared to conventional Group C. Onset of sensory block & motor block in conventional group C is longer as compared to US Group. *Conclusion:* US guided supraclavicular block is more successful technique with less number of complications and longer duration of block compared to Conventional technique.

Keywords: Brachial plexus;Pneumothorax; Sensory block; Upper Limb.

How to cite this article:
JC Makwana, Manan Shah, Arpit Shah. Comparison between Conventional Technique and Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgeries. Indian J Anesth Analg. 2020;7(1 Part -II):267-271.

Introduction

Ultrasound continues to grow in popularity as a method of nerve localization and for the supraclavicular block, has the advantage of allowing real time visualization of the plexus, pleura and vessels along with the needle and local anesthetic spread. Successful peripheral nerve and plexus blockade can provide an excellent anesthetic outcome.[1,2] There is a possibility of prolonged postoperative analgesia. Regional anesthetic techniques have specific advantages both for anesthesia and as analgesic supplements for intraoperative and postoperative care. Among the various approaches of brachial plexus block, supraclavicular approach is considered easiest and effective. It is carried out at the level of

Corresponding Author: Manan Shah, Senior Resident, Department of Anaesthesia, GMERS Medical College, Sola, Ahmedabad, Gujarat 380060, India.
E-mail: researchguide86@gmail.com
Received on 06.11.2019, **Accepted on** 03.01.2020

trunks of brachial plexus. The first supraclavicular brachial plexus block was performed in 1912. The conventional paresthesia technique being a blind technique may be with a higher failure rate and injury to nerves and surrounding structures. To avoid some of these problems, the use of peripheral nerve stimulator was started which allowed better localization of the nerve/plexus. However, this technique may not be foolproof with a persistent risk of injury to surrounding structures, especially vascular structures, nerves, and pleura leading to pneumothorax.[3] Ultrasound (US) visualization of anatomical structure are only method offering safe blocks of superior quality by best needle positioning. US allow direct visualization of peripheral nerves, the block needle, and local anesthetic distribution. Hence, a study is planned for comparison of brachial plexus block by supraclavicular approach using conventional and US based technique in terms of success rate of technique, number of complications observed, Time taken for the procedure, Onset and duration of sensory and motor blockade and duration of postoperative analgesia.[4,5]

The main objectives of this study were to compare the effects of supraclavicular brachial plexus block using conventional blind technique and US guided technique in terms of success rate of technique, number of complication observed, Time taken for the procedure, Onset and duration of sensory and motor blockade and duration of postoperative analgesia.

Materials and Methods

We studied 100 patients of Grade-I and Grade-II of American Society of Anesthesiologist's (ASA) classification and allocated them randomly into equal groups who were admitted from Nov 2015 to May 2017. Ethics Committee approval was taken before initiation of the study. In present study, we have enrolled patients of either gender of age more than 18 years and who were admitted for upper limb surgeries and with American Society of Anesthesiologists (ASA) Grade I and II physical status. All those patients who had history of peripheral neuropathy and history of allergy to local anesthetic agents were excluded from the study and also patients who diagnosed with local skin infections at site of injection and suffering from respiratory or cardiac disease or patients who are receiving chronic analgesic therapy or anticoagulant therapy were also excluded from the study.

All the patients were fasted adequately and were premedicated with tablet diazepam 10 mg and tablet ranitidine 150 mg in the night before surgery and in the morning of surgery. In the operation theater, patients were monitored with pulse oximetry (SpO_2), noninvasive blood pressure, and electrocardiogram. No other sedation was given till the evaluation of the block was completed.

Allocation of Groups

The patients were randomly allotted by closed envelope technique into either of the two groups:

Group C (Conventional) - To receive conventional supraclavicular brachial plexus block;

Group US (US guided) - To receive US guided supraclavicular brachial plexus block.

All enrolled patients were underwent following investigation:

In Group US, block is performed after real-time visualization of the vessels, nerve, and bone. In plane approach, using 10 ml syringe containing LA was injected, and the drug distribution was noted. In Group C, conventional supraclavicular brachial plexus was performed by eliciting paresthesia in the forearm and hand and when paresthesia was obtained we withdrew the needle about 1–2 mm and then, the drug was injected.

The time taken for the procedure, the onset of sensory and motor blockade was noted. Intraoperatively hemodynamic was monitored at regular intervals. Following completion of surgery, the patients were monitored to assess the quality and duration of postoperative analgesia. At the time of each subsequent assessment, patients were observed and/or questioned about any subjective and/or objective side effects (sedation, nausea, vomiting or respiratory depression, and neurological injury).

The various parameters noted were:

Time taken for the procedure;

Onset and duration of sensory neural blockade;

Onset and duration of motor blockade;

Duration of Analgesia.

Investigations

The following investigations had been done:

Blood investigations: Hemoglobin (Hb)%; Blood sugar; Blood urea.

Urine: Albumin; Sugar and microscopy;

Electrocardiography (ECG) and chest *X*-ray posterior anterior view depending on the age and associated comorbidities;

Human immunodeficiency virus;

Hepatitis B surface antigen.

Statistical analysis

The data were analyzed using SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

In present study, total 100 patients were enrolled and divided into Two Groups: Group C (Paresthesia) and Group US (USG). In both study groups, all the enrolled patients were in third decade of their age. It was also found that in both groups male patients were higher as compared to female patients, shown in Table 1.

In group USG, it was found that time taken for procedure, duration of sensory block (min), duration of motor blockade and duration of analgesia was significantly higher as compared to Group C and *p* - value was found < 0.0001. Whereas, time for onset of sensory block and motor block was found less in Group USG as compared to Group C and it was seen that time for onset motor block was significantly less in Group USG as compared to Group C, whereas, we did not find any significant difference between both study groups for time of onset of sensory block, shown in Table 2.

US Guided method was found total effective in 94% patients whereas, Conventional Method was

Table 1: Demographic Characteristics of the Study Population

Variables	Group C (Paresthesia) (*n* = 50)	Group US (USG) (*n* = 50)	*p* - value
Age (Yrs)	36.40 ± 12.02	36.84 ± 11.99	0.868
Weight (Kg)	57.18 ± 7.45	58.96 ± 8.01	0.250
Gender			
Male	28	35	0.21
Female	22	15	

Table 2: Comparison of various parameters among both groups

Parameter	Group C (Paresthesia) (*n* = 50)	Group US (USG) (*n* = 50)	*p* - value
Time taken for procedure (min)	6.05 ± 0.71	9.70 ± 1.21	< 0.0001
Onset of Sensory Block (min)	12.02 ± 1.16	11.82 ± 1.45	0.448
Onset of Motor Block (min)	17.02±1.281	15.81±1.24	< 0.0001
Duration of Sensory Block (min)	375.66 ± 17.478	402.56 ± 22.42	< 0.0001
Duration of Motor Blockade	355.88 ± 10.85	362.2 ± 17.02	0.0291
Duration of Analgesia	380.5 ± 21.31	412.52 ± 13.42	< 0.0001

Statistically significance at $p \leq 0.05$

Table 3: Comparison of Effectiveness among both groups

Parameter	Group C (Paresthesia) (*n* = 50)	Group US (USG) (*n* = 50)	test	*p* - value
Totally effective	36	47	Chi-square test 8.629	0.013
Partially effective	8	2		
Failure	6	1		
Total	50	50		

Statistically significance at $p \leq 0.05$

Table 4: Complication among both groups

Complication	Group C (Paresthesia) (*n* = 50)		Group US (USG) (*n* = 50)	
	N	%	N	%
Nerve injuries	0	0	0	0
Vessel puncture	6	12	2	4
Pneumothorax	1	2	0	0
Nil	43	86	48	96

found total effective in 72% of the patients and this shows total effectiveness was significantly higher in US guided Method as compared to Conventional method and this result was found statistically significant, *p* - value 0.013, shown in Table 3.

Discussion

Peripheral nerve blocks are cost effective anesthetic techniques used to provide good quality anesthesia and analgesia while avoiding airway instrumentation and hemodynamic consequences of general anesthesia. Patient satisfaction, a growing demand for cost effective anesthesia and a favorable postoperative recovery profile have resulted in increased popularity for regional techniques. Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries.[5] Supraclavicular approach to brachial plexus block is associated with rapid onset and reliable anesthesia. It can be given either after eliciting paresthesia or using nerve stimulator. Frequently cited disadvantages of paresthesia technique include patient discomfort on eliciting paresthesia and that its success is highly dependent on the cooperation of the patient. The prevalence of pneumothorax after a supraclavicular block is 0.5% to 6% and diminishes with experience.[6] The supraclavicular approach is best avoided when the patient is uncooperative or cannot tolerate any degree of respiratory compromise because of underlying disease. Other complications include frequent phrenic nerve block (40% to 60%), Horner's syndrome, and neuropathy.[7-10] The paresthesia based method and nerve stimulator based methods are blind methods; an advanced technique like use of ultrasound allows direct visualization of the nerves, the block needle, and local anesthetic distribution. This imaging modality has proven highly useful to guide targeted drug injections and catheter placement. The last several years have witnessed a tremendous increase in the use of ultrasound guidance for regional anesthesia.[11-14]

This study is intended to compare the conventional method by eliciting paresthesia with ultrasound guided supraclavicular brachial plexus block in terms of time taken for the procedure, onset and duration of sensory blockade, onset and duration of motor blockade, success rate, the incidence of complications and overall effectiveness. This prospective randomized nonblind clinical study was done in patients undergoing upper limb surgeries with similar demographic profile, shown in Table 4.

We considered the block to be successful when there is complete blockade of all sensory dermatome and at the sametime inability to move any of the upper limbs joint. In our study, the block was successful in 72% of patients in Group C compared to 94% in Group US. In the study of M Veeresham et al.[1], the block was found successful in 66.6% of patients in Group C and 80% in US Group respectively which is similar to present study results whereas, Gajendra singh et al.[2] found in their study that the block was successful in 73.33% of patients in Group C compared to 90% in US Group respectively. Success rate was not statistically significant. B Jeyarani, S Saiprabha[7] were demonstrated in their study that in US Group success rate was 1/3 times higher as compared to US conventional group and these results were similar to our study results.

In present study, among the 50 cases in ultrasound group, only two patients had vascular puncture of subclavian artery which resolved immediately with compression for 15 minutes. There was no incidence of pneumothorax, nerve injury or local anesthetic toxicity in ultrasound group. Among the 50 patient in conventional group, 6 patients had vascular puncture, in which only one went for hematoma formation which resolved within two days. One patient develops pneumothorax. No other complication was elicited in this group. The difference between the two groups was not statistically significant ($p > 0.05$). In the study of M Veeresham et al[1], they reported that there were no complications observed in USG group while in conventional group 20% of patients experienced complications like vessel puncture and nerve injuries. This study results were similar to Present study findings. Gajendra Singh et al.[2] reported incidence rate of complication was 3.33% in USG group while in conventional group incidence rate of complication was 10.00%, similarly in the study of Punam Raghove[3], in conventional group incidence of complications like pneumothorax 3.33%, vessel puncture 16.66% noted while in US group no complication noted.

In present study, we found that the duration of motor blocks in the two groups were also statistically significant ($p < 0.05$). In contrast to present study, M Veeresham et al.[1] reported the duration of sensory block and duration of motor block in two groups were statistically insignificant.

The duration of analgesia in the two groups were statistically extremely significant, ($p < 0.05$). An advanced technique like use of ultrasound allows direct visualization of the nerves, the block

needle and local anesthetic distribution adjacent to nerve plexus which helps in prolonging duration of analgesia. Punam Raghove et al.[3] and Bidyut Borah et al.[4], reported the total duration of analgesia in the two groups were statistically significant.

Limitations of the Study

In this study, we have fixed the doses of bupivacaine and lignocaine which were not based upon patient's body weight that may have influenced the results described here.

Conclusion

US guided supraclavicular block is more successful technique with less number of complications and longer duration of block compared to Conventional technique.

Conflict of Interest: None

Source of Support: Nil

References

1. Veeresham M, Goud U, P Surender, et al. Comparison between conventional Technique and ultrasound guided supraclavicular brachial plexus block in upper limb surgeries. Journal Evolution of Medical and Dental Sciences 2015;4(37):6465–476.
2. Singh G, Saleem MY. Comparison between conventional technique and ultrasound guided supraclavicular brachial plexus block in upper limb surgeries. Int J Sci Stud 2014;2(8):169–76.
3. Raghove P, Singh K, Taxak S, et al. Comparison of ultrasound guided technique with conventional landmark technique for supraclavicular brachial plexus nerve block in patients undergoing upper limb surgery. International Journal of Pharmacology and Clinical Sciences 2016;5(1):1–4.
4. Borah B, Engineer SR, Patel KB. A comparison of ultrasound *versus* paresthesia technique for supraclavicular brachial plexus block. International Journal of Advances in Medicine 2017;4(1):198–202.
5. Honnannavar KA, Mudakanagoudar MS. Comparison between conventional and ultrasound-guided supraclavicular brachial plexus block in upper limb surgeries. Anesth Essays Res 2017;11(2):467–71.
6. Mahajan R, Bhatia K, Malhotra S, et al. Supraclavicular Block Performance with Comparison between Ultrasound Guidance and Traditional Paresthesia Elicitation Technique. Sch J App Med Sci 2017 Feb;5(2B):407–441.
7. Jeyarani B, Saiprabha S. Comparison of ultrasound guided technique with conventional landmark technique for supraclavicular brachial plexus nerve block in patients undergoing upper limb surgeries. Indian Journal of Research 2017 July;6(7):31–34.
8. Dureja J, Siwach RC, Singh J, et al. Comparative evaluation of techniques in supraclavicular brachial plexus block: Conventional blind, nerve stimulator guided, and ultrasound guided. International Journal of Scientific Study 2016;3(12):125–28.
9. Mehta SS, Shah SM. Comparative study of supraclavicular brachial plexus block by nerve stimulator *vs* ultrasound guided method. NHL Journal of Medical Sciences 2015;04(01):49–52.
10. Rupera K, Khara B, Shah V, et al. Supra-clavicular brachial plexus block: Ultrasonography guided technique offer advantage over peripheral nerve stimulator guided technique 2013;03(03):241–44.
11. Singh S, Goyal R, Upadhyay K, et al. An evaluation of brachial plexus block using a nerve stimulator *versus* ultrasound guidance: A randomized controlled trial. Journal of Anesthesiology Clinical Pharmacology 2015;31(3):370–74.
12. Williams SR, Chouinard P, Arcand G, et al. Ultrasound guidance speeds execution and improves the quality of supraclavicular block. Anesth Analg. 2003;97(5):1518–23.
13. Mani KV, Veerapandiyan A, Radhakrishnan S. A study on comparison between ultrasound guided technique and peripheral nerve stimulator guided technique in performing brachial plexus block (supraclavicular approach) for upper limb surgeries. International Journal of Medical and Health Research. July 2017;3(7):61–64.
14. Ratnawat A, Bhati F, Khatri C, et al. Comparative study between nerve stimulator guided technique and ultrasound guided technique of supraclavicular nerve block for upper limb surgery. Int J Res Med Sci June 2016;4(6):2101–106.