10.5005/jp-journals-10046-0061

ORIGINAL ARTICLE

Ultrasound-guided Supraclavicular Nerve Block In-plane Technique: Comparison of Conventional *vs* Skin Wheal Standoff Technique

[1]Depinder Kaur, [2]Harshita Surange, [3]Pankaj N Surange, [4]Saurabh Anand, [5]Amit Choudhary, [6]Suchitra Malhotra

ABSTRACT

Introduction: The foremost advantage of ultrasound-guided peripheral nerve blocks is visualization of anatomical structures of interest and then depositing the local anesthetic for block. Supraclavicular block is the very commonly used block for upper limb surgeries.

Aim: The aim of our study is that for greater efficacy and safety of our blocks, we should use a technique in which we are not only visualizing the anatomical structures, but also the complete needle path and ultimately the deposition of local anesthetic in the vicinity of nerves and having a safe distance from adjacent structures like vessels and pleura.

Materials and methods: A total of 60 patients were accepted for study and divided into two groups of 30 each randomly. In group I, ultrasound-guided supraclavicular nerve block was given with skin wheal oblique standoff technique and in group II, the usual technique. Both the groups were compared in terms of better needle visualization, number of attempts, and success of block.

Results: In group I, we were able to visualize the complete path of needle in 70% of cases in first attempt as compared with group II in 40% of cases. In group I, 70% of blocks were placed in the first attempt as compared with 33% in group II. The p-value was <0.005 and difference was statistically significant. Similarly, operator fatigue, time for block placement, and corner pocket visualization were better in group I.

Conclusion: We have an opinion and recommendation from this study that by simple modification of the usual technique of giving supraclavicular block, i.e., raising a skin wheel, we can achieve greater success with our procedure.

Keywords: Oblique standoff technique, Supraclavicular block, Ultrasound.

[1]Assistant Professor, [2,3]Director, [4]Head, [5]Professor, [6]Associate Professor

[1,5,6]Department of Anesthesia, Shaheed Hasan Khan Mewati Government Medical College, Mewat, Haryana, India

[2]Department of Radiology, Diagnostic and Imaging Centre New Delhi, India

[3]Department of Pain Medicine, Interventional Pain and Spine Centre, New Delhi, India

[4]Department of Neuroanesthesia, Artemis Hospitals, Gurugram Haryana, India

Corresponding Author: Depinder Kaur, Assistant Professor Department of Anesthesia, Shaheed Hasan Khan Mewati Government Medical College, Mewat, Haryana, India, Phone: +919971888995, e-mail: pooja.anand15@yahoo.com

How to cite this article: Kaur D, Surange H, Surange PN, Anand S, Choudhary A, Malhotra S. Ultrasound-guided Supraclavicular Nerve Block In-plane Technique: Comparison of Conventional *vs* Skin Wheal Standoff Technique. J Recent Adv Pain 2017;3(1):25-29.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

The biggest advantage of ultrasound-guided nerve blocks is ability to visualize not only the anatomical structures, but also the needle path. We can increase the efficacy of our blocks by real time visualization of needle, its trajectory, deposition of local anesthetic as well as spread of local anesthetic. With practice and development of the trained eye, we are able to appreciate relevant anatomical structures, but while giving block, we still find to keep the needle and its tip in view is a bit of a difficulty.[1] For the in-plane approach, the free hand technique for transducer manipulation solves the problem of tip visualization, but after inserting the needle, if we keep on advancing without real time visualization, chances of vessels, nerves, and pleura injuries are higher.

There are many techniques for better needle visualization for either probe oriented or needle oriented. Transducer manipulation like translation and rotation[2] help to visualize the lost needle. However, as the needle passes into the body, it creates an angle with transducer and optimal visualization is lost. Obliquity of needle relative to transducer can be reduced by heel–toe technique for deeper structures or by oblique standoff technique for superficial targets. Oblique standoff technique is performed by elevating the transducer over the shallower part of needle. Air-filled space between the transducer and skin is filled with sterile gel. We used the oblique standoff technique with skin wheal instead of gel. We decided to compare the conventional way of giving supraclavicular block with modification of oblique standoff with skin wheal. Our purpose for raising skin wheal is to fill the gap between transducer and skin, and this was just to bring the transducer face more parallel to the needle. We compared two groups on the basis of accuracy of needle placement, visibility

Fig. 1: Skin wheal for standoff technique with 26 G needle

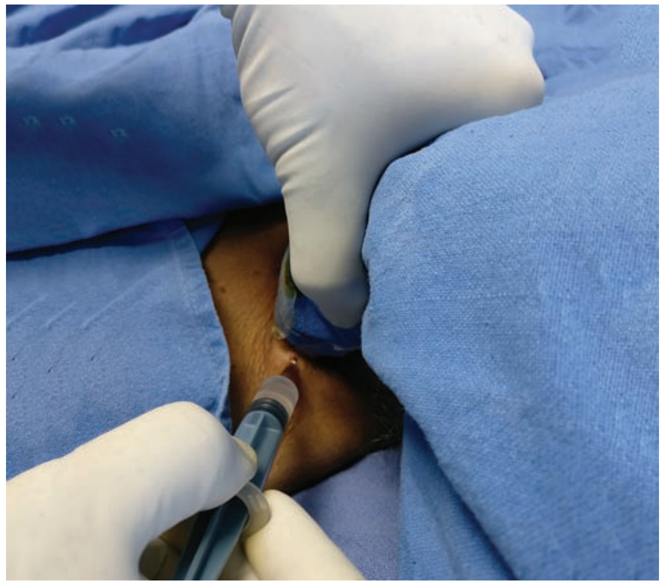

Fig. 2: Skin wheal for standoff technique with 22 G needle

of needle path, and better results in terms of efficacy of block with reduced time.

MATERIALS AND METHODS

After obtaining approval from the Shaheed Hasan Khan Mewati Government Medical College reviewer board along with the written informed consent, this prospective, randomized, parallel group study was conducted using 60 consecutive patients undergoing elective upper limb surgery under supraclavicular brachial plexus block. The inclusion criteria were age between 18 and 50 years, American Society of Anesthesiologists physical status I to II, and body mass index <$35kgm^{-2}$. The exclusion criteria included coagulation deficiency, known allergy to local anesthetics, neurologic deficit on the side of the operation, inflammation at the brachial plexus puncture site, respiratory insufficiency, or vocal cord palsy.

Eligible patients were equally randomized into two groups of 30 each using sealed envelopes. In group I, supraclavicular nerve block was given with skin wheal oblique standoff technique, while in group II, ultrasound-guided supraclavicular nerve block was given with usual technique with 22 G and 5 cm needles.

Placement of Block

The patients fasted starting at midnight and a peripheral intravenous infusion of ringer lactate was started 1 hour before surgery. On arrival to the operating room, electrocardiogram, pulse oximetry, and noninvasive arterial blood pressure monitoring were initiated. The patients were positioned supine with the head up and slightly rotated to the contralateral side and with the neck extended to facilitate the placement of the ultrasound-guided brachial plexus block (Table 1). In group I, supraclavicular block was performed with oblique standoff technique. After raising significantly elevated visible skin wheal with 3 mL of local anesthetic at the shallower part of needle with a 26 G needle, and then a block needle 22 G 5 cm was used as shown in Figures 1 and 2.

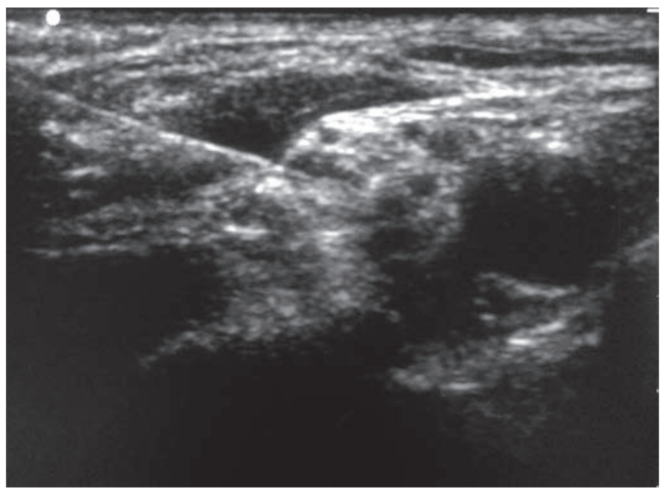

Fig. 3: Path of needle

Complete path of the needle is shown in Figure 3. About 20 to 25 mL of local anesthetic was given and the following parameters were assessed as shown in the tables given below. In group II, after skin disinfection, the supraclavicular block was performed with 22 G 5 cm needle without local anesthesia to skin by advancing needle from lateral to medial direction along the long axis in-plane view of high-frequency linear probe placed in coronal plane in supraclavicular fossa. About 20 to 25 mL of local anesthetic was given depending upon spread of local anesthetic.

Table 1: Block placement and success

Time for placement of block measured from needle prick to removal of needle after placement of block		
Score 1		Complete path of needle visualized
Score 2		Some part of needle visualized
Score 3		Some part of needle visualized with tissue movement
Score 4		Some part of needle visualized with hydro dissection and tissue movement
Score 5		Nothing is visualized, reinsertion required
Number of attempts		
Score 1	I	Single attempt and complete path of needle visualized
	II	Single attempt and part of needle path visualized
Score 2	I	Second attempt and complete path visualized
	II	Second attempt and part of needle path visualized
Score 3		Three or more than three attempts for part of needle to be visualized
		Time taken for block placement
Score 1		<10 minutes
Score 2		10–15 minutes
Score 3		>15 minutes
Corner pocket localization and block		
Score 1		Corner pocket block with complete path visualization
Score 2		Corner pocket block done with only spread of local anesthetic visible
Score 3		Could not block because of invisibility of needle
Success of block		
Score 1		Complete block with no pain
Score 2		Almost complete with supplementation of local anesthetic
Score 3		Failed block with performance of second block

Statistical Analysis

The analysis includes profiling of patients on different demographic, clinical, and laboratory parameters. For each of these two groups, namely groups I and II, quantitative data were presented in terms of means and standard deviation and qualitative/categorical data were presented as absolute numbers and proportions. Cross-tabulations were generated and chi-square test was used for testing of association. Mann–Whitney U test was used for comparison of ordinal outcome parameters and standard normal deviate test for proportions. The p-value <0.05 is considered statistically significant. Statistical Package for the Social Sciences software, version 24.0, was used for analysis.

RESULTS

Out of 60 patients who participated in the study, no patient underwent general anesthesia due to pain that was not relieved by brachial plexus block. There was no significant difference in demographic data of both the groups. In group I, we were able to visualize complete path of needle in 84% of cases (Table 2) as compared with 40% of cases in group II in first insertion attempt as shown in Table 3. Only in one case in group I, nothing was visualized and reinsertion of needle was required. The p-value was 0.009 and difference was statistically significant. In skin wheal technique, our purpose was to align the needle parallel to transducer face while introducing for block. Number of attempts was lesser as compared with the conventional technique. About 70% of cases were blocked with single attempt as compared with 33% in group II. The p-value was <0.005 and difference was statistically significant as shown in Table 3.

Operator fatigue and time for placement of block was <10 minutes in 86% of cases in group I as compared with 46% of cases in group II as shown in Table 4. With our experience in supraclavicular block, we have seen that deposition of local anesthetic at corner pocket ensues dense and complete block. With our technique, in 86% of cases, we were able to locate the corner pocket and block it, while in group II, because of less visibility of needle, we were able to block it in only 46% of cases. The p-value was 0.002, and difference was statistically significant as shown in Table 5. A successful block is one in which we have complete effect with no pain to patient. With skin wheal standoff technique, we were able to achieve

Table 2: Visualization of needle trajectory

Score	*Group I (n = 31)*	*Group II (n = 35)*	*Total (n = 66)*
1	26 (83.9)	14 (40.0)	40 (60.6)
2	2 (6.5)	6 (17.1)	8 (12.1)
3	1 (3.2)	4 (11.4)	5 (7.6)
4	1 (3.2)	5 (14.3)	6 (9.1)
5	1 (3.2)	6 (17.1)	7 (10.6)

Chi-square value = 13.455; p-value = 0.009; p-value <0.05, statistically significant.

Table 3: Number of insertion attempts

Score		*Group I (n = 30)*	*Group II (n = 30)*	*Total (n = 60)*
1	I	17 (56.7)	6 (20.0)	23 (38.3)
	II	4 (13.3)	4 (13.3)	8 (13.3)
2	I	8 (26.7)	10 (33.3)	18 (30.0)
	II	1 (3.3)	6 (20.0)	7 (11.7)
3		0 (0.0)	4 (13.3)	4 (6.7)

Chi-square value = 13.054; p-value = 0.011; p-value <0.05, statistically significant.

Table 4: Time for block placement

Score	*Group I (n = 30)*	*Group II (n = 30)*	*Total (n = 60)*
1	26 (86.7)	14 (46.7)	40 (66.7)
2	4 (13.3)	16 (53.3)	20 (33.3)
3	0 (0.0)	0 (0.0)	0 (0.0)

Chi-square value = 10.8; p-value = 0.001; p-value <0.05, statistically significant.

Table 5: Corner pocket

Score	Group I (n = 30)	Group II (n = 30)	Total (n = 60)
1	26 (86.7)	14 (46.7)	40 (66.7)
2	4 (13.3)	10 (53.3)	14 (23.3)
3	0 (0.0)	6 (20.0)	6 (10.0)

Chi-square value = 12.171; p-value = 0.002; p-value <0.05, statistically significant.

Table 6: Success of block

Score	Group I (n = 30)	Group II (n = 30)	Total (n = 60)
1	22 (73.3)	12 (40.0)	34 (56.7)
2	7 (23.3)	15 (50.0)	22 (36.7)
3	1 (3.3)	3 (10.0)	4 (6.6)

Chi-square value = 9.349; p-value = 0.009; p-value <0.05, statistically significant.

successful block in the first attempt with visualization of complete path in 74% of cases as compared with 40% cases in group II. The p-value was 0.009, which was statistically significant as shown in Table 6.

DISCUSSION

From routine elicitation of paresthesia to peripheral nerve stimulators and now ultrasound guided nerve block. With time, the field of regional anesthesia is evolving, and as our eyes are trained for anatomical details, we want to see our drug to be delivered at the right place. Needle visualization during ultrasound-guided nerve block is essential for safety and efficacy of block. There are two methods of orienting the needle relative to the ultrasound beam in ultrasound-guided peripheral nerve blocks: The in-plane and out-of-plane approaches.[3]

However, there are a number of techniques by which we can increase the visibility of needles. These techniques can be transducer movements[2] or use of specialized needles[4,5] or it may be related to tissue movement,[6,7] but by the time we apply them, operators experience fatigue and impatience. Looking at these shortcomings, we designed a study in which we used the basic principle of ultrasound ergonomics and aligning the needle beam angle with which we tried to localize the needle.

During the in-plane approach, the conspicuity of the needle is primarily dependent on the angle of the needle with the transducer face. A larger angle (due to a steeper trajectory) renders the needle less conspicuous. A needle-beam angle close to 90° offers best needle visibility using the in-plane needle approach.[8-11]

Coordinating transducer and needle positions is integral to maintaining optimal visualization.[12-14] Even though the transducer may be directly over and parallel to needle as viewed from surface after translation and rotation, but as the needle passes into tissues to reach the target structure, it creates an angle with the transducer face. As a result, the ultrasound beam does not hit the needle shaft perpendicular, and the needle becomes less echogenic and so less visible. We have to reduce the obliquity of needle relative to the transducer to make it visible.

For deeper structures, we use heel–toe technique to visualize the needle by pushing the transducer over deeper part of needle. For superficial structures, when there is less deformable soft tissue oblique gel standoff technique is used. We modified this technique by raising a skin wheal of significant height to elevate transducer over shallower part of needle. So, by filling the gap between skin and transducer with skin wheal, we are aligning the needle parallel to the transducer.

One more aspect of supraclavicular block is to block the corner pocket for complete and dense block. The area inferomedial to the plexus, posterolateral to the subclavian artery, and superior to the first rib, is commonly referred to as "the corner pocket."[15-17] Many studies advocate that depositing local anesthetic first in the corner pocket lifts the brachial plexuses and results in complete block. As corner pocket block may cause pleura or vessel puncture, needle visualization is a prerequisite for deposition of local anesthetic agent. With our technique, as we are better to appreciate the needle path, it theoretically decreases chances of complications.

CONCLUSION

In conclusion, after analyzing results and viewing the success and simplicity of our technique, we recommend that the skin wheal standoff technique should be used routinely for superficial ultrasound-guided peripheral nerve blocks. Technique is very simple in that before giving block, give local anesthesia at shallower part of needle path and raise the skin wheel a good height to elevate transducer. Now, perform the block without wasting time in a single attempt for complete and dense block under vision.

REFERENCES

1. Sites B, Spence B, Gallagher J, Wiley CW, Bertrand ML, Blike GT. Characterizing novice behavior associated with learning ultrasound-guided peripheral regional anesthesia. Reg Anesth Pain Med 2007 Mar-Apr;32(2):107-115.
2. Marhofer P, Chan VW. Ultrasound-guided regional anesthesia: current concepts and future trends. Anesth Analg 2007 May;104(5):1265-1269.
3. Gray AT. Ultrasound-guided regional anesthesia: current state of the art. Anesthesiology 2006 Feb;104(2):368-373.
4. Bergin D, Pappas JN, Hwang JJ, Sheafor DH, Paulson EK. Echogenic polymer coating: does it improve needle visualization in sonographically guided biopsy? AJR Am J Roentgenol 2002 May;178(5):1188-1190.
5. Jandzinski D, Carson N, Davis D, Rubens DJ, Voci SL, Gottlieb RH. Treated needles: do they facilitate sonographically guided biopsies? J Ultrasound Med 2003 Nov;22(11): 1233-1237.

6. Matalon TA, Silver B. US guidance of interventional procedures. Radiology 1990 Jan;174(1):43-47.
7. Perlas A. A concerning direction: in response. Anesthesiology 2004;100:1326-1327.
8. Culp WC, McCowan TC, Goertzen TC, Habbe TG, Hummel MM, LeVeen RF, Anderson JC. Relative ultrasonographic echogenicity of standard, dimpled and polymeric-coated needles. J Vasc Interv Radiol 2000 Mar;11(3):351-358.
9. Deam RK, Kluger R, Barrington MJ, McCutcheon CA. Investigation of a new echogenic needle for use with ultrasound peripheral nerve blocks. Anaesth Intensive Care 2007 Aug;35(4):582-586.
10. Bondestam S, Kreula J. Needle tip echogenicity. A study with real time ultrasound. Invest Radiol 1989 Jul;24(7):555-560.
11. Schafhalter-Zoppoth I, McCulloch CE, Gray AT. Ultrasound visibility of needles used for regional nerve block: an *in vitro* study. Reg Anesth Pain Med 2004 Sep-Oct;29(5):480-488.
12. Smith J, Finnoff JT. Diagnostic and interventional musculoskeletal ultrasound: part 1. Fundamentals. PM R 2009 Jan;1(1):64-75.
13. Smith J, Finnoff JT. Diagnostic and interventional musculoskeletal ultrasound: part 2. Clinical applications. PM R 2009 Feb;1(2):162-177.
14. Sites BD, Brull R, Chan VW, Spence BC, Gallagher J, Beach ML, Sites VR, Hartman GS. Artifacts and pitfall errors associated with ultrasound-guided regional anesthesia. Part I: understanding the basic principles of ultrasound physics and machine operations. Reg Anesth Pain Med 2007 Sep-Oct;32(5):412-418.
15. Fredrickson MJ, Patel A, Young S, Chinchanwala S. Speed of onset of "corner pocket supraclavicular" and infraclavicular ultrasound guided brachial plexus block: a randomized observer-blinded comparison. Anaesthesia 2009 Jul;64(7):738-744.
16. Franco C. Supraclavicular brachial plexus block. In Hadzic A, editor. Textbook of regional anesthesia and acute pain management. New York: McGraw Hill; 2007. p. 420-421.
17. Soares LG, Brull R, Lai J, Chan VW. Eight ball, corner pocket: the optimal needle position for ultrasound-guided supraclavicular block. Reg Anesth Pain Med 2007 Jan-Feb;32(1):94-95.