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Original Research Paper

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EVALUATION OF SUCCESS RATE AND COMFORT STATUS OF PATIENT IN ULTRASOUND GUIDED APPROACH AS COMPARED TO CONVENTIONAL BLIND APPROACH OF SUPRACLAVICULAR BRACHIAL BLOCK IN UPPER EXTREMITY SURGERIES

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ABSTRACT

Background: The supraclavicular technique is regarded to be the most straightforward and efficient way to block the brachial plexus for surgeries on the upper extremities. The conventional blind approach used is the traditional and classical technique using the anatomical landmarks and ultrasonography (USG) guidance can provide real time visualisation of the clusters of nerve roots in brachial plexus. **Aim and Objectives:** The current study compares USG and anatomical landmarks technique for supraclavicular brachial plexus blocks used for upper extremity procedures in terms of the timing of the commencement of motor as well as sensory blockade, the overall duration and comfort of patients while the procedure, and any complications. **Study design:** Randomized, prospective controlled study. **Material and Methods:** 60 patients of over 18 years of age who were planned undergo elective upper extremity surgical procedures were randomly divided into one of the two groups. Supraclavicular brachial plexus blocks were given to patients in the Group U under the supervision of ultrasound, while anatomical landmark technique was applied to the Group A. Bupivacaine 0.5% 15 ml and lignocaine 2% with 1:200000 adrenaline 10 ml were used as the local anaesthetic mixture in both groups. Independent t-test and Chi-square test are used to compare group means for categorical data. Results: The USG procedure was shorter than the anatomical landmark technique procedure (11.56 ± 2.71 min vs. 21.70 ± 4.84 min). When compared to Group A, in Group U sensory block onset time 12.88± 3.60 min vs.16.21 ± 3.66 min in anatomical landmarks technique and motor block onset time (23.16 ± 4.48 min vs. 27.16 ± 3.77 min) were both considerably shorter ($P < 0.05$). Overall duration of sensory blockade remained substantially longer in Group USG (8.18 ± 0.95 hrs) than in Group A (7.28 ± 1.46 hrs), (P=0.0077). Nobody in either set of patients experienced any complications.**Conclusion:** In comparison to the conventional blind technique using anatomical landmarks, the ultrasound guided supraclavicular brachial plexus blockade can really be performed more rapidly and results in a rapid onset of sensory and motor block.

KEYWORDS : Brachial Plexus block; conventional blind technique ; anatomical landmarks technique ; Supraclavicular block; Ultrasound.

Introduction

The most straightforward and efficient method for blockade of the brachial plexus is thought to be the supraclavicular technique. The old approach of locating the nerve bundle utilizing paraesthesia and anatomical characteristics may have a higher failure rate and cause injury to nerve fibres or vascular systems[1]. Anatomical landmarks are classical approach to go for but is difficult in case of distorted anatomy[2]. The application of ultrasonography (USG) to find the brachial plexus has proved groundbreaking in regional anaesthesia. The only drawbacks are the price and the level of knowledge needed [4]. This study compared the procedure times, block properties, comfort of patients during the procedure and complication rates of the two procedures mentioned above.

Aim and Objectives: The current study compares USG and anatomical landmark technique for supraclavicular brachial plexus blocks used for upper extremity procedures in terms of the timing of the commencement of motor and sensory blockade, the overall duration of procedure and comfort of patient, the length of the procedure, and any complications.

Material and Methods

Following approval from the institution's ethics committee, 60 patients undergoing elective upper limb surgery were enrolled.

Inclusion criteria: Individuals between the ages of 18 to 80 years with ASA physical status classifications I to II.

Exclusion criteria: Lack of willingness to participate, known neurological illnesses, coagulation disorders, skin infection at the site of block, and any known allergy to local anaesthetic drugs.

The day before surgery, a preanesthetic checkup was performed on each patient. Tablet Ranitidine 150 mg & tablet Metoclopramide 10 mg with tablet Lorazepam 1 mg were given orally to the patients the night well before procedure as well as two hours prior. Patients were moved to the operating room on call, where they underwent normal monitoring procedures such as heart rate, blood pressure, ECG and pulse oximetry. The non-operating hand was used for intravenous cannulation.

The groups A and U were randomly assigned to all patients. The local anaesthetic solution was a 25 ml combination of 0.5% Bupivacaine 15 ml, 2% lignocaine with 1:200,000 adrenaline 10 ml.

Group U (n=30): Ultrasound-guided supraclavicular block. A Sonosite Ultrasound device with a linear transducer of 4 cm and 6– 13 MHz of frequency range of was used for the procedure. An extension of 10 cm with an 18G cannula needle attached was used to administer medication. Patients were positioned supine with such a shoulder roll underneath them, their heads were tilted away from the blocked side, and an arm was placed downward along the trunk to drag down their ipsilateral clavicle. The ultrasound probe was placed in an oblique plane in the supraclavicular region using a sterilized plastic sheath. The brachial plexus was first identified as a honeycomb-like hyperechoic and hypoechoic structure situated above first rib & pleura, also laterally to the subclavian artery.Just after lignocaine 2% infiltration of the skin, an 18G needle attached to a three-way connection was inserted through the skin. The subclavian artery served as a reference when the needle was progressively inserted into the brachial plexus sheath after being shown on the screen. Normal saline 2 cc was injected under vision to track the spread. After confirming an adequate spread after a negative aspiration, at least two separate needle sites were utilised to inject the local anaesthetic mixture deeper into the brachial plexus sheath, both of which were located near the subclavian artery.

Group A (n=30): Anatomical landmark supraclavicular block With the skin properly prepped, the subclavian artery subsequently located in the supraclavicular region, and 2% lignocaine was injected into the skin lateral to the artery. The needle entered about in an inch laterally from where the sternocleidomastoid attaches to the clavicle. The needle was inserted through the skin in a downward and inward motion.

With this method, the needle is directed from the upper trunk (shoulder twitch) to the medial trunk (tingling over triceps, biceps, and pectoralis) and then down to the fingers (lower trunk). The purpose of this block was to induce a flexion or extension twitch in the fingers, thereby repositioning the needle's location closer to the lower trunk. After confirmation of tingling from patient achieving paresthesia over fingers of ipsilateral side, local anaesthetic was given after negative aspiration.

The procedure time is calculated as the time between the initial needle insertion and the final needle removal at the end of the block. The entire upper limb's cutaneous innervation, including the musculocutaneous, median, radial, medial cutaneous nerve of arm & forearm, ulnar, and intercostobrachial nerves, underwent sensory examination for pain and touch. The following scale was used to rate each dermatome's sensory block:

1. 2 - normal sensory perception
2. 1–reduced sensory perception (hypoesthesia)
3. 0 - no sensory perception.

The onset timing of sensory block for each nerve was calculated as the time between the removal of the needle of block and the point at which a score of zero was achieved. By u sing a modified Bromage score scale for the upper extremities, motor block was assessed at 5, 10, 15, 20, & 30 min after drug administration.[5] Flexibility, abduction, extension, and adduction of the elbow, wrist, & fingers were evaluated. Motor block onset was defined as the time between the withdrawal of the needle of block and the attainment of a modified Bromage grade of 0.

Modified Bromage grade to assess motor weakness in upper limb:
1. Grade 0: Whole range of motion in the elbow, wrist, and fingers
2. Grade 1: Having flexible wrists and fingers
3. Grade 2: Flexing and extending fingers solely
4. Grade 3: Whole motor block, including the incapacity to move the elbow, wrist, or a finger.

During the surgery, light sedation (intravenous Midazolam 1-2 mg) was provided. Fentanyl 1 mcg/kg intravenously was administered as a supplement in the event that analgesia was insufficient. If the patient was still in pain after receiving general anaesthesia, the block was considered unsuccessful. Before being allowed back to their respective wards, all patients were observed for one full postoperative hour in the recovery facility. In addition, the following was noted:

1. The requirement for supplemental systemic medicine during surgery
2. Converting from regional to general anaesthesia (block failure) Deleterious effects were noted, which were classified as vascular puncture, cardiac arrhythmias, seizures, SpO2 < 90%, Horner's phenomenon, symptoms of local anaesthetic toxicity, and pneumothorax

3. Using a 10-point score visual analogue scale (0 = no pain, 10 = the worst pain imaginable), postoperative pain at the operative site was measured. A score greater than three was utilised as the cutoff for the duration of the blockade. 24 hours following the block, participants were monitored for complications such as pneumothorax and persistent paresthesia.

Statistical analysis

SPSS version 16.0 was used to conduct statistical analysis (SPSS Inc., Chicago, IL, USA). For continuous variables, the data were expressed as mean and standard deviation; for categorical variables, they were expressed as numbers and percentages. The mean between both the groups was compared using an independent t-test, comparing categorical variables using the Chi-square test. Statistics are considered significant at $P < 0.05$.

Results

The patients in both groups had similar means for age, gender, weight, & ASA physical state categorization ($P > 0.05$). Systolic and diastolic blood pressure, as well as the mean heart rate was comparable amongst the groups. In Group U, the average operation took 11.56 ± 2.71 minutes, but in Group A, it took 21.70 ± 4.84 minutes. This distinction was significant statistically ($P < 0.0001$). Statistically significant difference was observed ($P = 0.0009$) in terms of the mean time of onset of sensory blockade (score 0) was 12.82 ± 3.46 min in Group U and 16.09 ± 3.36 min in Group A. The mean time of onset of motor block was also statistically significant, and it was 27.16 ± 3.77 min in Group A and 23.16 ± 4.48 min in Group U. ($P = 0.0003$).

According to Table 1, Group U had a considerably longer mean sensory block duration than Group A (8.11 ± 0.91 min vs. 7.26 ± 1.42 min) with ($P = 0.0077$). The mean length of the motor block did not significantly differ between the two groups, though. The need for intravenous fentanyl replenishment was not significantly different either. Neither group's patients experienced any adverse outcomes such artery puncture, nerve damage, pneumothorax, or local anaesthetic toxicity. As compared to Group U, only five of the 30 patients in Group A required intravenous fentanyl supplementation as an analgesic, albeit this difference wasn't really statistically significant. Neither group's patients needed to be converted to general anaesthesia.

Table 1: Parameters of block

Parameters	Group U (n=30) (Mean±SD)	Group A (n=30) (Mean±SD)	P-Value
Procedure time (min)	11.56±2.71	21.70±4.84	<0.0001 (HS)
Onset of sensory block (min)	12.88±3.60	16.21±3.66	0.0007(HS)
Onset of motor block (min)	23.16±4.48	27.16±3.77	0.0005 (HS)
Duration of sensory block (hrs)	8.18±0.95	7.28±1.46	0.0075 (HS)
Duration of motor block (hrs)	6.02±0.74	5.31±1.51	0.0602 (NS)

HS – Highly Significant, NS – Not Significant

Discussion

The supraclavicular block is one of the most popular procedures for brachial plexus blockage because it reliably and reliably anaesthetizes the whole upper limbs[6]. In 1978, La Grange et al. reported using Doppler USG to locate subclavian vessels in order to conduct supraclavicular blocks [7].

The danger of harm to the adjacent structures is reduced by using USG, which aids in localization of the brachial plexus while guiding the needle. This study compared the effectiveness and complication rates of the two procedures mentioned above for executing supraclavicular block.

Singh et al., demonstrated considerably lower procedural time in U group when compared to A group in supraclavicular block (8.14 v/s 10.63 minutes, respectively), which was similar to our study in which, the mean procedure time was considerably shorter in U group when compared to A group (11.58 ± 2.73 min vs. 21.74 ± 4.84 min, respectively) (8.14 v/s 10.63 minutes, respectively) [6].

Similarly, Williams et al. & Ratnawat et al. found that performing the block utilizing USG as opposed to anatomical landmark technique required significantly less time [7,8]. Despite this, Duncan et al. discovered that the two aforementioned procedures had comparable execution times

[9]. The A group's operation took a little longer than that of the USG group's because of the diverse relationship between the surface morphology and nerve location. In addition, the conventional blind anatomical landmarks approach required additional time because the initial response occurred at the shoulder, and the needle site had to be significantly changed posteriorly to elicit finger twitches and necessarily requires multiple needle entries and needle readjusting, longer process times were unavoidable. However, positioning and any required needle repositioning are performed under direct visualization while using USG guidance.

When compared to A Group (16.11 ± 3.56 min and 27.13 ± 3.87 min, respectively), the mean times for both sensory block onset & motor block onset were observed to be considerably shorter in USG Group (12.88 ± 3.60 min and 23.16 ± 4.48 min, respectively). This is comparable to the study of Ratnawat et al., in which the U group experienced considerably shorter mean times for sensory block onset and motor block onset (6.46 ± 1.02 and 8.10 ± 1.02 min, respectively) than the A group (7.68 ± 1.33 min and 9.94 ± 1.28 min, respectively). [10] Our results, however, were in contrast to those of a study by Duncan et al., where the U and A groups' sensory and motor blockade onset times were comparable [11].

When compared with Group A (7.28 ± 1.46 h), the mean duration of nerve block seemed significantly longer in Group U (8.18 ± 0.95 h). Nonetheless, both groups' average motor block durationswere comparable (P = 0.0602). Using inj. Ropivacaine 0.5% 30 ml solution, Ratnawat et al. found that the U group's sensory as well as motor block lasted substantially longer (8.13 ± 1.63 h and 7.13 ± 1.63 h, respectively) than that of the A group's (6.14 ± 2.36 h and 5.14 ± 2.36 h, respectively).10 Moreover, Singh et al. noted an extended block with U. Our results are in contrast to those of Duncan et al., who found that a 1:1 combination of 0.5% bupivacaine, 2% lignocaine, and 1:200,000 adrenaline resulted in sensory and motor durations that were equivalent between the USG & anatomical landmarks groups [9]. The supraclavicular block assisted by sonographic imaging helps determine the size, depth, and precise location of the surrounding structures, as well as their anatomy.

USG aids in the precise insertion of the needle, aids in distributing the local anaesthetic at the correct spot, and aids in visualizing the drug's distribution. This, in turn, accelerates the beginning of the blockade and may account for the extended length of block observed in our study.

In our study, 5 out of 30 participants in Group A needed intravenous Fentanyl to complement their analgesia, although none of the participants in Group U did. This was shown to be statistically insignificant using Fisher's exact t-test (P = 0.052). There were no block failures in either group since none of the participants in either group needed to be converted to general anaesthesia. According to Singh et al., of the 102 participants, 45 out of 50 (90%) participants had successfully developed a block with USG, as opposed to 38 out of 52 (73.1%) patients in Group A who required further nerve blocks (P = 0.028) [8]. Duncan et al. and Williams et al. observed a similar occurrence of the successful block with both USG and Anatomical landmark technique, despite the fact that block failure occurred with both groups. Jeon and Kim reported that the success rate when employing an A for supraclavicular brachial block was 93.7% and 75%, respectively, when both distal and proximal responses were observed [10]. In our investigation, the A group experienced both proximal and distal muscular reactions, which would explain their lack of block failures.

In our study, which was equivalent to that of Duncan et al., neither group was reported to have experienced artery puncture, pneumothorax, or nerve injury. Singh et al. discovered 7 arterial punctures in the anatomical landmark group as opposed to one in the USG group after check aspiration [9]. Many studies have proven a minimal or low incidence of complications when utilising USG, as it permits direct visualization of the needle in relation to the cervical pleura, hence reducing pleural puncture and pneumothorax formation [11-14].

Limitations of the study: A comprehensive multicentric study will give a more accurate depiction of the occurrence of complications, such as artery puncture and pneumothorax. In our experiment, we did not keep track of the needle pricks and realignments that are necessary for evaluating discomfort, pain, and satisfaction.

Conclusion

Utilizing USG-guided supraclavicular block, we observed a shorter duration of the treatment and a speedier onset of sensory and motor block. In addition, the USG technique significantly lengthened the sensory block compared to the anatomical landmark procedure. With neither of the two surgeries, complications such as artery rupture, nerve injury, or pneumothorax occurred.

During upper limb surgeries, the USG-guided supraclavicular block method performed markedly better than that of the anatomical landmark method in terms of procedural timing and block characteristics. Moreover, anatomical landmark technique can be utilized safely in circumstances when expertise as well as access to USG machines is restricted. In order to evaluate and compare the frequency of difficulties with various procedures, additional research with a larger sample size is necessary.

REFERENCES

1. Carty S, Nicholls B. Ultrasound-guided regional anaesthesia. Continuing Education in Anaesthesia Critical Care & Pain. 2007;1:20–4.
2. 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. Study Group on Regional Anesthesia. Anesth Analg. 1999;88:847–52.
3. Gaumann D, Forster A, Griessen M, Habre W, Poinsot O, Della Santa D, et al. Comparison between clonidine and epinephrine admixture to lidocaine in brachial plexus block. Anesth Analg. 1992; 75:69–74.
4. Greenblatt GM, Denson JS. Needle nerve stimulatorlocator: Nerve blocks with a new instrument for locating nerves. Anesth Analg. 1962;41:599–602.
5. la Grange P, Foster PA, Pretorius LK. Application of the Doppler ultrasound

bloodflow detector in supraclavicular brachial plexus block. Br J Anaesth. 1978; 50: 965–7.
6. Singh S, Goyal R, Upadhyay KK, Sethi N, Sharma RM, Sharma A, et al. An evaluation of brachial plexus block using a nerve stimulator versus ultrasound guidance: A randomized controlled trial. J Anaesthesiol Clin Pharmacol. 2015; 31: 370–4.
7. Williams SR, Chouinard P, Arcand G, Harris P, Ruel M, Boudreault D, et al. Ultrasound guidance speeds execution and improves the quality of supraclavicular block. Anesth Analg. 2003;97:1518–23.
8. Ratnawat A, Bhati FS, Khatri C, Srinivasan B, Sangwan P, Chouhan DS. Comparative study between nerve stimulator guided technique and ultrasound guided technique of supraclavicular nerve block for upper limb surgery. Int J Res Med Sci. 2016; 4: 2101–6.
9. Duncan M, Shetti AN, Tripathy DK, Roshansingh D, Krishnaveni N. A comparative study of nerve stimulator versus ultrasound-guided supraclavicular brachial plexus block. Anesth Essays Res. 2013;7:359–64.
10. Jeon DG, Kim WI. Comparison of a supraclavicular block showing upper arm twitching response with a supraclavicular block showing wrist or finger twitching response. Korean J Anesthesiol. 2010; 58: 464–7.
11. Rupera KB, Khara BN, Shah VR, Parikh BK. Supra-clavicular brachial plexus block: Ultra-sonography guided technique offer advantage over peripheral nerve stimulator guided technique. Natl J Med Res. 2013;3:241–4.
12. Yuan JM, Yang XH, Fu SK, Yuan CQ, Chen K, Li JY, et al. Ultrasound guidance for brachial plexus block decreases the incidence of complete hemi-diaphragmatic paresis or vascular punctures and improves success rate of brachial plexus nerve block compared with peripheral nerve stimulator in adults. Chin Med J (Engl). 2012; 125: 1811–6.
13. Kapral S, Krafft P, Eibenberger K, Fitzgerald R, Gosch M, Weinstabl C, et al. Ultrasound-guidedsupraclavicular approach for regional anesthesia of the brachial plexus. Anesth Analg. 1994; 78: 507–13.