

Comparison of Ultrasound Guided Technique with Conventional Landmark Technique for Supraclavicular Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgery

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ABSTRACT

Background: Brachial plexus blockade is a time tested anesthetic technique for upper limb surgeries. Among the various approaches of brachial plexus block, supraclavicular block, once described as the “spinal of the arm,” offers dense anesthesia of the brachial plexus for surgical procedures at or distal to the elbow. Landmark technique has been traditionally used for performing this block. But blind technique often requires multiple trial-and-error needle attempts, resulting in increase in procedure time, procedure-related pain and complications including pneumothorax, which is very risky. In developing countries like India, ultrasound is a relatively new technique and is increasingly being used for performing nerve blocks for acute as well as chronic pain procedures. **Objective:** We performed this study to evaluate safety and clinical usefulness of ultrasound technology for supraclavicular brachial plexus blocks. **Methods:** We included 60 adult patients of either sex undergoing surgeries for fracture of lower end of humerus or fracture of forearm bones. Patients were divided into two groups. In one group, surface landmark technique was used while in other group, supraclavicular nerve block was performed under ultrasound guidance by double injection technique. All patients received 10 ml each of 2% lignocaine with adrenaline, 10 ml 0.5% bupivacaine and 10 ml of saline. Surgery was started after confirming adequacy of block. Ineffective blocks were replaced with general anesthesia and insufficient pain control during surgery was supplemented with fentanyl. **Results:** There was no significant difference between patient groups with regard to demographic data. Supraclavicular plexus nerve block was placed in all 60 patients. Block failure was seen in 5 patients in landmark technique group and in one patient in USG group. The time of onset of sensory and motor block was shorter in USG group than landmark technique group. Intra-op analgesic was required in 5/30 patients in blind group and 3/30 patients in USG group. Post-op analgesia was for longer duration in USG guided group as compared to blind group. **Conclusion:** Ultrasound guidance is clinically very useful for supraclavicular brachial plexus block. It allows visualization of underlying structures, movement of needle and direct spread of local anesthetic and thus making the procedure safer and more effective.

Key words: Supraclavicular brachial plexus block, Ultrasound, Upper limb surgery, Landmark, Nerve block.

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INTRODUCTION

Supraclavicular nerve block is ideal for procedures of upper arm, from midhumeral level down to hand. Brachial plexus is most compact at the level of trunks formed by C5–T1 nerve roots, so blockade here has greatest likelihood of blocking all of the branches of brachial plexus. But the proximity of the brachial plexus at this location to pleura has resulted in unacceptable high incidences of

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pneumothorax (0.5% to 6 %) which has been of concern to many practitioners.^[1] USG guidance provides real time visualization of anatomical structures and needle movement and has decreased the complication rates.^[2] We performed this study to evaluate safety and usefulness of ultrasound for supraclavicular brachial plexus blocks in comparison to blind landmark based technique.

METHODS

60 adult patients of either sex, age 18-60, ASA physical status I and II with fracture lower end of humerus or both bone forearm were included in the study.

Exclusion Criteria

1. Patients with respiratory or cardiac disease
2. Patients having history of allergy to local anesthetic agents
3. Patients having peripheral neuropathy
4. Patients receiving chronic analgesic therapy or anticoagulant therapy.

Pre-anesthetic evaluation was done one day before surgery and patients were advised NPO for six hours before surgery. Informed consent was taken explaining the procedure to patient.

In premedication room, IV line was started and one mg of midazolam was given intravenous before block. Local site was cleaned and draped taking all aseptic precautions. Supraclavicular block was performed with patient in supine position and head turned to opposite side. 30 ml of drug {Lidocaine 2% with adrenaline (1:200000) 10 ml, Bupivacaine (0.5%) 10 ml and Normal Saline 10 ml} was used for the block. Patients were randomly divided in two groups.

Landmark technique (Blind) group

The subclavian artery was palpated in supraclavicular fossa and immediately lateral to it, a subcutaneous wheal was raised with 1% lignocaine using a 23 G needle. A 21 G needle was then inserted through the skin wheal in a backward, inward, and downward direction. Drug was injected once paresthesia was elicited. In the absence of paresthesia, drug was injected on first rib by walk over technique.

USG group

Sonosite M-Turbo ultrasound with HFL 38×13-16 MHz 40 mm broadband linear array probe was used for block. Sterility of probe was ensured by using sleeve and transparent tegaderm on ultrasound probe. Sterile water based jelly was used as a coupling agent. Probe was placed in coronal oblique plane over lateral half of supraclavicular fossa and subclavian artery was identified. Subclavian artery is seen as anechoic, hypodense, pulsatile and round. Artery can be further confirmed by color Doppler. Brachial plexus appears as a cluster of hypoechoic “grape-like” structures. Supraclavicular nerve block was performed under ultrasound guidance by double injection technique. 23 g spinal needle was inserted under real time ultrasound visualization using in plane technique. 15 ml of drug was injected between pulsating subclavian artery and first rib after negative aspiration. Then needle direction was changed and drug was injected superior-lateral to subclavian artery to block upper trunk. Deposition of 15 ml local anesthetic between artery and rib, lifted the subclavian artery and made subsequent injection easier. Onset of nerve blockade was judged by sensory blockade-pin-prick, temperature and motor blockade-push, pull, pinch, pinch. Patients were transferred to operating table. Surgery was started after confirming adequacy of the block. Ineffective blocks were replaced with general anesthesia and insufficient pain control during surgery was supplemented with fentanyl.

RESULTS

Demographic profile was comparable in two groups (Table 1). In landmark technique group, 11 patients had Fracture lower end humerus, 16 had fracture of Both bone forearm (BBFA) and 3 had fracture of Lower end humerus and BBFA. In USG group, 12 patients had Fracture lower end humerus, 14 had fracture of Both bone forearm (BBFA) and 4 had fracture of Lower end humerus and BBFA (Table 2). Supraclavicular block was placed in all 60 patients. Block failure was seen in 5 patients in landmark technique group and in one patient in USG group. The time of onset of sensory and motor block was shorter in USG group than landmark technique group (Table 3). Intra-operative analgesic (fentanyl 100 mg) was required in 5/20 patients in blind group and 3/20 patients in USG group. Mean duration of surgery was 105 min (40-155 min). Post-op analgesia in USG guided group was for longer duration as compared to blind group. One pneumothorax and five blood reflux/aspiration were noted in blind group while no such complications were noted in USG group (Table 3).

Sex	Land mark Technique SCB	USG guided SCB
Male	17	14
Female	13	16

Fracture Site	Land mark Technique SCB	USG guided SCB
Fracture lower end humerus	11	12
Both bone forearm(BBFA)	16	14
Lower end humerus and BBFA	3	4

Group	Landmark (n=30)	USG (n=30)
Onset time (sensory block) in min*	16.10 ± 4.12	12.20 ± 5.71
Onset time (motor block) in min*	19.74 ± 7.18	15.40 ± 6.21
Block Failure	5	1
Supplemental analgesia	5	3
Duration of analgesia*	232 ± 47	312 ± 54
Pneumothorax	1	0
Blood aspiration	5	0

* p ≤ 0.05.

DISCUSSION

Supraclavicular block provides dense anesthesia of upper limb and was described as the “spinal of the arm”.^[3] At this point, the brachial plexus is compact and a small volume of solution produces rapid onset of reliable blockade of the brachial plexus. An additional advantage is that the block can also be performed with the patient’s arm in any position. It can be done using surface landmarks alone or with nerve stimulator. But landmark technique is associated with high failure rate and unacceptable high rates of complications like pneumothorax.^[1] Due to these, use of supraclavicular brachial plexus fell out of favor. With introduction of ultrasound imaging for regional nerve block, this technique has seen resurgence in recent years. In fact, the first descriptions of ultrasound-guided blocks were in the supraclavicular region.^[1]

In this study, we achieved successful block for surgery in 97% patients in USG group and 83% patient in landmark technique. Chan *et al* in their study in 40 patients also reported 95% success rate using ultrasonic guidance for supraclavicular block.^[5] Hopkins PM demonstrated an improved success rate using ultrasound guidance for any regional anesthesia technique.^[6] Chan *et al* also found that the block success rate was higher in US guided group (82.8%) than NS guided group (62.9%) for axillary brachial plexus block.^[7] In our study, onset of sensory and motor block was also earlier in USG group as compared to other group. USG guided block also provided longer lasting analgesia. All these desired effects of USG guided technique may be explained due to accurate deposition of local

anesthetic in close proximity of brachial plexus resulting in faster and dense block of nerve. We used two injection techniques in USG guided block which provides complete block of brachial plexus as compared to single injection technique.^[8-10] Septae or a tight muscular membrane between the scalene muscles separates roots of the plexus and as a result injection into a single location may not result in the spread of the injected drug into all the compartments.^[11] In this study, there were no serious complications in USG group whereas one pneumothorax was detected in landmark technique group. Kapral *et al.* also observed no complications such as pneumothorax, puncture of a major blood vessel or nerve paresis in his study of US guided supraclavicular approach brachial plexus blockade.^[12] This is due to real time visualization of underlying anatomical structures and needle movement. Pleura and first rib are easily visualized with ultrasound and pneumothorax can be avoided by not entering in this ‘No Fly Zone’. Thus Real time ultrasonography has made supraclavicular very safe and useful method for regional anaesthesia of upper limb.

One limitation of this study is that only 60 patients were included in this study. A large number of patients will give us better idea about the incidence of complications like intravascular injection and pneumothorax, which are less common with use of ultrasound.

CONCLUSION

Ultrasound guidance is very useful for supraclavicular brachial plexus block. It allows real time visualization of

underlying structures, movement of needle and spread of local anesthetic, resulting in safer and more effective block as compared to landmark technique.

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