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An open label randomized comparative study on axillary *vis a vis* supraclavicular approaches for brachial plexus block in forearm surgery

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ABSTRACT

Aims and Objectives: Regional anesthesia like brachial plexus blocks are increasingly practiced nowadays avoiding the complications of general anesthesia for upper limb surgery. Among the many techniques axillary and supraclavicular approaches are common though both have its merits and demerits. This study was planned to compare these two techniques in terms of onset, completion time of sensory and motor blockade, its duration and overall success during forearm surgeries. **Materials and Methods:** After obtaining institutional ethics committee approval and written informed consent, 100 patients of American Society of Anesthesiologists grade I or II scheduled for forearm surgeries were included in the study and were randomly allocated into two groups. 30ml of the 0.5% bupivacaine was injected either by supraclavicular or axillary blockade site by a single trained experienced anesthetist. The onset and completion time of sensory and motor blockade, its duration and overall success were noted and the collected data was statistically analyzed. **Results:** The patients (n = 100) predominantly female (56%) with comparable demographic profile found to have equal efficacy in onset of sensory block, extent of motor blockade, duration of block in both the group. However considering overall effectiveness of the techniques including their failure rates, axillary approach appeared to be more acceptable and a better technique ($p < 0.05$). **Conclusion:** Axillary approach could be a safer choice among regional block for the conduct of forearm surgery.

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INTRODUCTION

Regional anesthesia is becoming important in clinical practice, especially with the introduction of more effective and safer techniques. Peripheral nerve blocks have attracted renewed interest because of their salutary role in reducing postoperative pain[1] and shortening outpatient recovery.[2] For appropriate and most effective use of these techniques, the clinicians need to understand anatomy, physiology of nerve fiber and physicochemical effects of local anesthetic drugs on the nerve fibers.

Nowadays regional anesthesia especially the brachial plexus block, though difficult to perform with some failures, is preferred for upper limb surgeries. Many in the past have tried different techniques to provide more effective and safer technique of brachial plexus block for upper limb surgery. Among the various techniques of brachial plexus block, supraclavicular and axillary blocks are in common practice.

Axillary block has been practiced in the past by many workers like Leonard Brand and E. M. Papper,[3] Captain Rudolph De Jong,[4] and they found it to be suitable due to better compliance of patients and relatively easier technique with fewer side effects like axillary hematoma, neurovascular injuries etc. Supraclavicular block has also been practiced in past by many workers like Leonard Brand

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and E. M. Papper,[3] Dr. Dilip Kothari,[5] and they found it suitable for upper limb surgeries especially arm & forearm region with side effects of local hematoma, pneumothorax and neurovascular injuries.

Thus earlier studies revealed that authors differ in their opinion regarding suitability of supraclavicular and axillary blocks for upper limb surgeries. Hence the study was planned to compare these two techniques in terms of onset and completion time of sensory and motor blockade, its duration and overall success in cases of forearm surgeries.

MATERIALS AND METHODS

After obtaining approval from the institutional ethics committee, a written informed consent was obtained from (n=100) patients classified as American Society of Anesthesiologists (ASA) Grade I or II of either sex aged between 20 and 60 years scheduled for elective orthopedic and soft tissue surgery of forearm and were included in the study. Unwilling patients, patients with history of allergy to local anesthetics, infection at local site of block, progressive neurological disorders, severe kidney dysfunction, severe liver dysfunction, history of bleeding disorders history of convulsions, bleeding disorders, cardiac, respiratory, renal or liver ailment were excluded.

After securing an intravenous access with appropriate cannula, all patients were premedicated with glycopyrrolate 0.2mg intra muscularly 30minutes before surgery prior to shifting in the operating room. All the patients were made aware of their pain assessment by pinprick. Non invasive monitors e.g [ECG, Non invasive blood pressure (NIBP), pulse-oximeter] were attached and a baseline parameters (SpO2, pulse rate, blood pressure, and respiratory rate were recorded. The patients were then allocated to receive the block either by supraclavicular Group S (n=50) or axillary Group A (n=50) approach by permuted block randomization. All regional blocks were given by a qualified senior anesthesiologist using 30 ml of bupivacaine hydrochloride (0.5%) at block site. Assessment of the patients of both groups and their data capturing was done openly by the investigators. No one was blinded in this study.

Supraclavicular block was achieved with the patient of group-S. Patients were made to lie supine without a pillow, arms at the side, head turned slightly to the opposite side with the shoulders depressed posteriorly and downward by molding the shoulders over a roll placed between the scapulae. The supraclavicular area was aseptically prepared and drapped. The anesthesiologist stood at the side of the patient to be blocked, behind the head of the patient, since this position allowed better control of needle. After taking aseptic measures an intradermal wheal was raised approximately 1cm above the midclavicular point. The subclavian artery palpable in supraclavicular fossa was used as landmark. The tip of index finger was rested in supraclavicular fossa directly over the arterial pulsation. The needle was inserted through skin and advanced slowly downward (caudal) rolled slightly inward (medially) and slightly backward (posteriorly). After confirming negative aspiration of blood, 30ml of the 0.5% bupivacaine was injected and the needle was fixed in position after paresthesia was elicited with 25G, 2cm needle.

For axillary approach the patient was held in the supine position with the arm to be blocked placed at a right angle to the body and the elbow flexed to 90 degrees. The dorsum of the hand was rested on the bed or pillow; hyper-abduction of the arm with placement of the hand beneath the patient's head was not allowed because this position frequently obliterates the pulse.

The axillary artery was palpated, and a line was drawn tracing its course from the lower axilla as far proximally as possible. The artery was then fixed against the patient's humerus by the index and middle fingers of the left hand, and a skin wheal was raised directly over the artery at a point in the axilla approximating the skin crease. Placement of the needle proximally and maintenance of distal pressure facilitate proximal spread of the solution. Paresthesia was sought with a 25G, 2cm needle and a total of 30ml of the 0.5% bupivacaine was injected. If the musculocutaneous nerve was not blocked by the axillary approach then it was blocked by injection within the body of the coracobrachialis muscle or at the elbow superficially at the lateral aspect of the antecubital fossa just above the interepicondylar line.[6]

As soon as the anesthetic drug was injected for initiation of block, the time was noted as "zero time". Time of onset of sensory block in each group was recorded using pinprick in skin dermatomes by a 25G needle once in every 3 minutes for the first 30 minutes after injection and there after every 30 minutes till patient regained normal sensations. The same observer assessed the motor block at same time intervals.

In this study the onset of sensory block was described from the time (in minutes)of injection of drug to time of first detection of diminished sensation and completion of sensory block was from the time of injection of drug to time of loss of pain on pinprick. Again onset of motor block was designated from the time of injection to time of first detection of diminished power and completion

of motor block was from the time of injection of drug to time of complete loss of movement.

Duration of sensory blockade was the time in minutes from the onset of analgesia to the recurrence of pain to pin prick. Duration of motor blockade was the time in minutes from the onset of paresis to the recovery of motor movements.

The quality of sensory and motor block was studied and labeled as successful when the blocks were complete and failed when blocks were incomplete or totally absent. In those cases general anesthesia was given and was excluded from the study. Motor block was graded according to the movement of upper limb by the patient as: Grade 5- normal movement of upper limb, 4-movement against resistance, 3-movement against gravity, 2-movement along gravity but not against resistance, 1-flickering movement and 0-no movement. A Grade of 3, 2 or 1 was considered as partial block. A Grade of 0 was considered as complete motor paralysis i.e. the patient could not move his limb at all. A Grade of 2 to 5 motor activity after administration of block was considered as failure of block.

The pulse rate, blood pressure, respiration rate and SpO_2 were recorded at intervals of 5 minutes for initial 30 minutes then at every 15 minutes for up to 180 minutes. The patients were monitored for any complications like bradycardia, convulsions, restlessness, disorientation, drowsiness and any other complications. Fluid management was done depending upon fluid deficit, maintenance requirement, nature of operation, blood loss etc.

METHOD OF STATISTICAL ANALYSIS

The data were analyzed by using computer software Microsoft Excel and SPSS 12.0 for windows. Baseline comparability was ensured employing appropriate statistical tests. . Group sizes (50 patients per group) were determined using the proportion sample size estimates (type 2 error = 80%, type 1 error = 0.05) to detect a 20% difference in the rates of complete sensory block at 50 min. Chi-square test was then employed to find the p-value at various time intervals. All analysis was two sided and a P value of <0.05 was considered to be statistically significant. The final results were interpreted in charts and tables.

RESULTS

The present study was conducted on (n=100) consented patients aged between 20-60 years excluding the failed blocks (n=14). Patients received 30ml of 0.5% bupivacaine by Supraclavicular approach (Group-S) or Axillary approach (Group-A).

There were no differences between the two groups with regard to height, weight, gender, age and duration of surgery or American Society of Anesthesiologists grades (Table 1). The distribution of age, sex, weight, mean duration of surgery was comparable between the two groups and was statistically insignificant. The mean time of onset of motor blockade, its completion and duration between the groups was not statistically significant (Figures 1-3).

The overall success rate in terms of effectiveness of the blockade of Group-S was 81.97% (50/61) as compared to 94.34% (50/53) in Group A. The difference was statistically significant ($p<0.05$) which signifies that the supraclavicular approach of brachial plexus blockade had more incidences of failures as compared to axillary approach (Table 2).

The incidence of common but serious complications in this study was lesser in axillary approach as compared to supraclavicular technique with zero occurrence of pneumothorax (Figure 4).

The mean pulse rate, blood pressure, respiratory rate changes and oxygen saturation of haemoglobin during the surgical operations were statistically insignificant in patients recruited for either technique of block (Figures 5a and b, 6 and 7).

DISCUSSION

The present study was undertaken to compare the efficacy of supraclavicular and axillary blocks for different types of forearm surgeries. As the incidence of forearm surgeries are increasing, suitable technique for regional anesthesia with less complications and effective anesthesia for successful operations is the basic need of the time to avoid general anesthesia particularly in patients with co-morbid illness.

The study was conducted on (n=100) patients, 50 in each group after permuted block randomization (eliminating the failure blocks) with comparable demographic data in terms of age, weight and sex in both the groups. A wide range of surgeries were performed in patients of each group. The techniques employed were simple and straightforward.

Earlier studies of Leonard Brand and E M Papper,[3] De Jong[4] and Schroeder et al[7] with a group of 230 supraclavicular blocks and 246 axillary blocks, 94 axillary blocks and 46 supraclavicular blocks respectively which recruited more participants as compare to our study. Although the age, sex & weight range of patients taken in our group was comparable with these study groups.

Table 1: Demographic characteristics of the study participants

Sl no.	Demographic profile	Group S (n=50)	Group A (n=50)
1	Gender		
	Male	21 (42%)	23 (46%)
	Female	29 (58%)	27 (54%)
2	Age (yrs)		
	21-30	16	16
	31-40	14	12
	41-50	11	12
	51-60	09	10
3	Weight (kg)		
	41-50	06	05
	51-60	20	17
	61-70	17	24
	71-80	07	04
4	Surgical procedures: (No. of cases)		
	Lower Ulna Excision	4	3
	Open reduction & internal fixation-Ulna (U)	12	14
	Open reduction & internal fixation-Radius (R)	2	2
	Open reduction & internal fixation-U+R	17	17
	Radial Head Excision	3	5
	Skin Graft	7	5
	Tendon Repair	5	4
5	Duration of surgery (minutes)		
	46-60	12 (24%)	10 (20%)
	61-75	19 (38%)	17 (34%)
	76-90	12 (24%)	14 (28%)
	91-105	7 (14%)	9 (18%)

Group S: Supraclavicular brachial plexus block, Group A: Axillary brachial plexus block

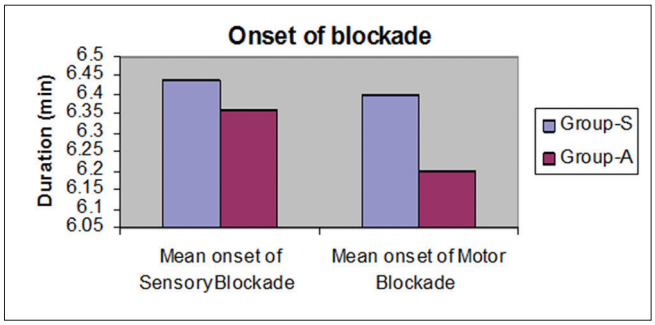

Figure 1: Average duration of onset of sensory & motor blockade among the study participants

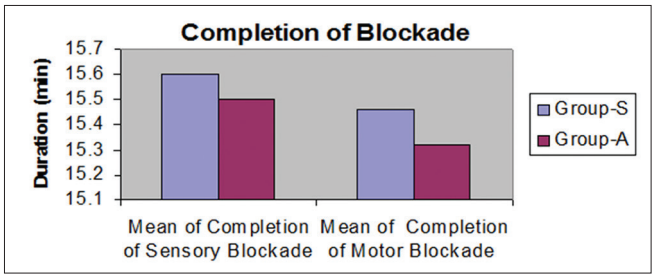

Figure 2: Average duration of completion of sensory & motor blockade among the study participants

The characteristic of the regional blocks like onset, completion & duration was in the range of 5-6 minutes, 15-18 minutes and 180-220 minutes respectively in the studies mentioned earlier (3, 4, 7) which are quite comparable with the current study.

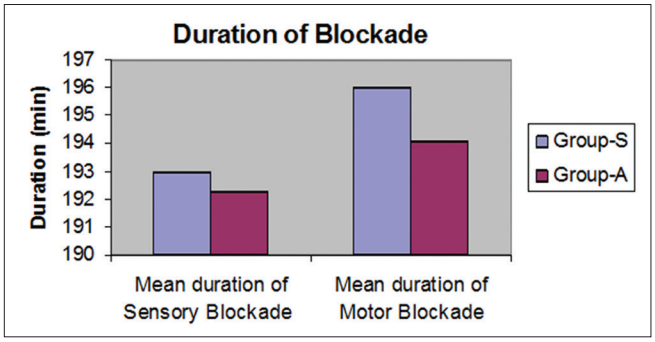

Figure 3: Average duration of sensory & motor blockade among the study participants

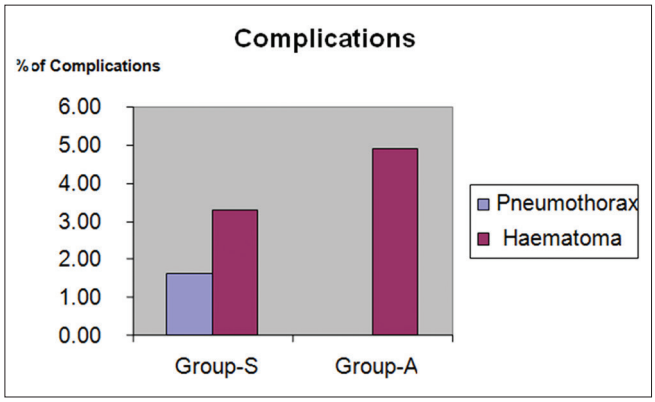

Figure 4: Occurrences of complications among the study participants

Similarly the success rate of supraclavicular block and axillary block of L. Brand and E. M. Papper[3] was 84.1% and 91.5%

Table 2: Overall effectiveness of the two methods of blockade among the study participants

	Success	Failure	Total	%Success	%Failure
Group-S	50	11	61	81.97%	18.03%
Group-A	50	3	53	94.34%	5.66%
Total	100	14	114		

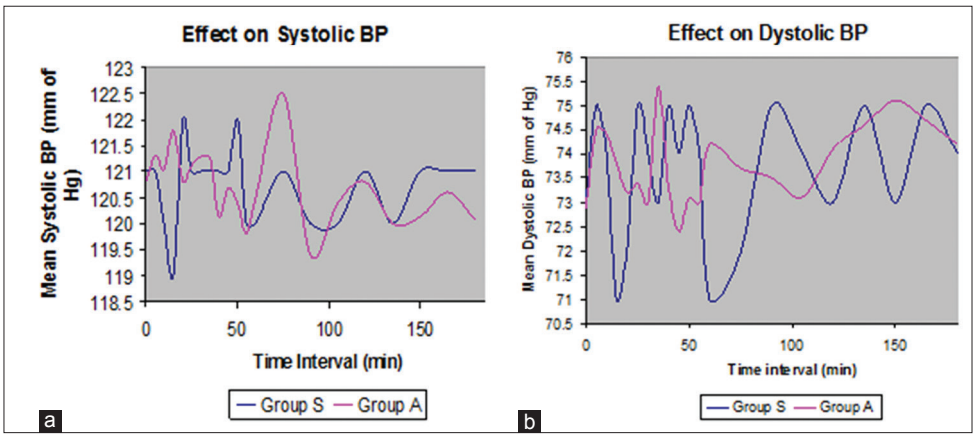

Figure 5: (a, b) Effects on systolic & diastolic blood pressure during regional anesthesia among the study participants

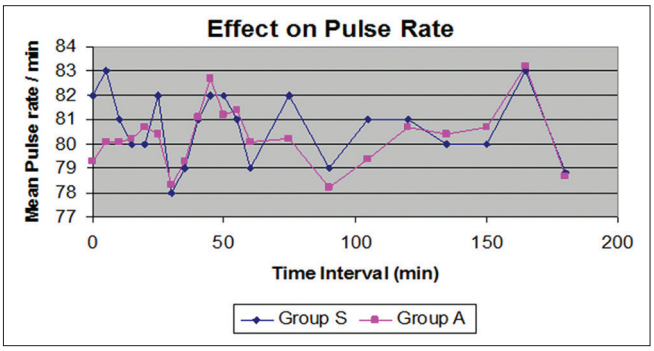

Figure 6: Effects on pulse rate during regional anesthesia among the study participants

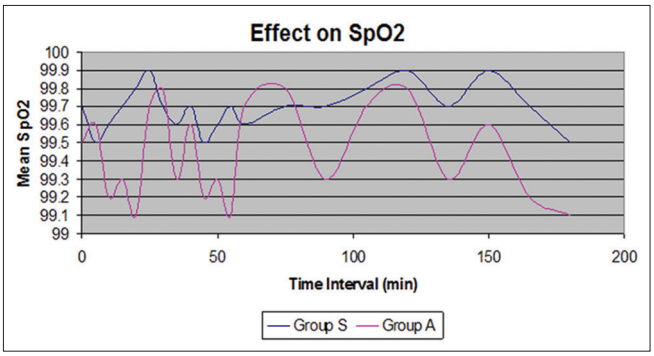

Figure 7: Effects on partial pressure of oxygen (SpO2)during regional anesthesia among the study participants

whereas in De Jong[4] it was 91.5% for axillary block which is at par with our study with a success rate of 81.97% in supracalvicular block and 94.3% in axillary block respectively.

The complications like hematoma found in supraclavicular block and axillary block of L Brand and E M Papper[3] was 0.8% and 1.2% respectively. While in De Jong study[4] there was no unacceptable complications found. The incidence of pneumothorax was 6.1% in supraclacicular block & 0 % in axillary block in the study of L. Brand and E. M. Papper[3] while there is was no incidence of pneumothorax found in De Jongs[4] study in axillary block. According to Miller's anesthesia[6] the incidence rate of pneumothorax in supraclavicular block was 0.5-6%. In our study the complications found in supraclavicular block and axillary block was 9.83% and 9.43% respectively while hematoma was 3.28% and 4.91% respectively. The incidence rate of pneumothorax in supraclavicular block was 1.6% and 0% in axillary block. Thus it is observed that both supraclavicular and axillary blocks have a very low incidence of complications. Complications observed in our study were similar to other works. Furthermore complications observed in axillary block were less serious in nature.

CONCLUSION

We have demonstrated that both techniques provide adequate surgical anesthesia for forearm surgeries. Both the approaches are equally efficacious as far as the onset of sensory block, extent of motor blockade, duration of block (analgesia) although the in terms of effectiveness axillary approach appears to be statistically significant ($p<0.05$) as compared to supraclavicular block. Since this study reflects that the chances of procedural complications like pneumothorax is much less in axillary block it could be a safer choice for practice by the anesthetist. The addition of modern gadgets like nerve locator, ultrasound guided, and catheter technique will further increase the scope

of effective peripheral blocks with lesser hazards to the patient.

REFERENCES

1. Liu SS and Francis VS. Continuous plexus and peripheral nerve blocks for postoperative analgesia. Anaesthesia and Analgesia 2003; 96:263-272.
2. Pavlin DJ, Rapp SE and Polissar NL. Factors affecting discharge time in adult outpatients. Anaesthesia and Analgesia 1998; 87:816.
3. Leonard B and Papper EM. A comparison of supraclavicular and axillary technique for brachial plexus block. Anesthesiology 1961; 22: 2269.
4. De Jong RH. Axillary block of the brachial plexus. Anesthesiology 1961;22:215-225.
5. Kothari D. Supraclavicular brachial plexus block: a new approach. Indian J Anaesth 2003; 47 (4):287-288.
6. Miller RD et al. Miller's Anesthesia, 7th ed, Churchill Livingstone: 2009: pp 1669.
7. Schroeder LE, Horlocker TT and Schroeder DR. The efficacy of axillary block for surgical procedures about the elbow. Anesth Analg 1996; 83(4):747-751.

Authors Contribution:
AG - Concept and design of the study, reviewed the literature, manuscript preparation and critical revision of the manuscript; **KKD -** Literature search, statistically analyzed and interpreted, prepared first draft of manuscript and critical revision of the manuscript.

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