COMPARATIVE STUDY OF UPPER LIMB BLOCKS GIVEN WITH THE HELP OF USG MACHINE (USG GUIDED) AND CONVENTIONAL METHOD

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ABSTRACT

BACKGROUND

Upper limb blocks are most commonly performed for upper extremities surgery due to their high success rate, early ambulation, less hospital stay, and prolonged post op pain relief. Supraclavicular brachial plexus block, and inter scalene block provide anaesthesia for almost all upper limb surgeries. As they provide dense block and also relives tourniquet pain, these techniques were chosen for upper limb surgeries for my study. We wanted to compare the success rate, dose of drugs, and density of the block given, with the help of USG and with conventional method

METHODS

In this prospective, randomised, double blinded comparative study, 50 patients ASA class 1 or 2 of either sex, in the age group of 20-50 years, scheduled for orthopaedic upper extremity surgery were included. The patients were divided into 2 random groups group A (n=25) (conventional method) and Group B (n=25) (USG guided). Onset of sensory blockage, motor blockage (by Bromage scale and pinprick), local anaesthetic requirement, postop rescue analgesia, and complications were compared. Chi-square test and independent t-test were used to compare qualitative and quantitative data, respectively.

RESULTS

Mean dose of lignocaine given in the group A (201.6 ± 27.03 mg) and in group B (188.96 ± 29.51 mg) was statistically not significant. Mean onset of sensory blockage was (13.49 ± 1.70 minutes) in group A and (8.56 ± 0.95 minutes) in group B, statistically significant and motor blockage was (15.96 ± 1.56 minutes) in group A and (10.62 ± 1.68 minutes) in group B, statistically significant.

CONCLUSIONS

Using USG machine to perform brachial plexus block helps to increase the success rate of block, speed onset of sensory and motor block, provides dense block, reduce requirement for rescue analgesia and decreases the incidence of complications.

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BACKGROUND

Upper limb blocks are most commonly performed for upper extremities surgery due to their high success rate, early ambulation, less hospital stay, and prolonged post op pain relief. Supraclavicular brachial plexus block and inter scalene block provide anaesthesia for almost all upper limb surgeries. As they provide dense block and also relives tourniquet pain, these techniques were chosen for upper limb surgeries for my study. Though few potential complications like pneumothorax, hematoma, injury to vessels, local anaesthetic toxicity, phrenic nerve palsy are described with these techniques, they can be minimized with proper technique.

USG guided upper limb blocks are superior to conventional methods because of closed proximity of local anaesthetic to nerve under direct vision reducing the chances of vascular injury, complications and increasing the potential of block.

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METHODS

This prospective, randomised, double blinded comparative study was conducted in 50 orthopaedic patients, ASA grade I or II of either sex, aged between 20 to 50 years, posted for upper limb surgeries done under inter scalene or supraclavicular block after approval by Institutional Ethical Committee. A detailed history was taken, and the patient were thoroughly examined before surgery and written consent was taken. Patients with allergy to lignocaine[1] or bupivacaine[2,1] infection at the site of injection, anomalies of neck and shoulder, fracture clavicle, coagulopathy, pregnant woman, history of IHD, uncontrolled hypertension, respiratory disease, COPD, asthma, hepatic or renal disease, convulsion were excluded from the study. After enrolment, group assignments were determined by a computer-generated number sequence and contained in sequentially numbered opaque envelops to ensure blinding. The patients were divided into 2 groups.

Group A
(n=25) (Conventional Method) Patients were given 4 mg/kg Inj. Lignocaine + 2 mg/kg Inj. Bupivacaine + 5 ml normal saline.

Group B
(n=25) (USG guided) Patients were given 4 mg/kg Inj. Lignocaine + 2 mg/kg Inj. Bupivacaine + 5 ml normal saline. This group has received reduced dosage of local anaesthetic by 20% compared to dose needed according to their weight.

Pulse, blood pressure and respiratory rate were measured in pre-anaesthesia room, intravenous line was established on the contralateral arm and the patients were premedicated with Inj. Glycopyrrolate 0.004 mg/kg and Inj. Ondansetron 4 mg intravenously half an hour before performing the block and Inj. Midazolam 0.02 mg/kg intravenously on arrival in operation theatre. The patients were taken in operation theatre and placed in supine position. A bolster of adequate size was placed between the shoulder blades. After turning the head to opposite side, painting and draping of the supra-clavicular region along with side of the neck was done. A supra clavicular block was performed by classical approach[3] with 23x1.5G needle and neurovascular bundle was located by walking the needle anteriorly and posteriorly along the first rib. Inter scalene block was performed by palpating groove between the anterior scalene and middle scalene muscle[4,5,6] with 23 x 1.5G needle and locating neurovascular bundle by moving the needle anteriorly and posteriorly. The drug was injected on obtaining paraesthesia after negative aspiration for blood. Sonosite M Turbo ultrasound[7] with HFL probe of 38X13-16 MHz 40 mm broadband linear array probe was used for block. Sterility of the probe was ensured by using sleeve on ultrasound probe. 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 colour doppler[8]. Brachial plexus appears as a cluster of hypoechoic "grape like" structures. Supraclavicular block was performed under real time ultrasound guidance[9,10] using 23G spinal needle using in plane technique. (Figure -1) Inter scalene block (ISB) was performed by tracing the brachial plexus upwards along the course between the anterior and middle scalene muscle. Between the scalene muscle brachial plexus appears as a "traffic signal light" structure. Inter scalene nerve block was performed under real time ultrasound guidance using 23 G spinal needle around perineural sheath using in plane technique. (Figure -2)

Onset of Sensory Nerve Blockage was judged by 3 Point Sensory Score

- 0 – Sharp pain on pinprick.
- 1 – Touch sensation on pinprick.
- 2 – Not even touch sensation on pinprick.
- Onset of sensory blockage was taken as the time between injection and the complete ablation of pinprick (sensory score 2).

Motor blockage was Assessed by a 3-Point Motor Score Described by Bromage

- 0 – Full flexion and extension of elbow, wrist and fingers.
- 1 – Ability to move fingers only.
- 2 – Inability to move fingers.

Onset of time for motor blockage was considered as the time from performance of block to the time when a complete inability to move fingers (Motor score 2).

Ineffective blocks were replaced with general anaesthesia and insufficient pain control during surgery was supplemented with Inj. Fentanyl[11] and these patients were excluded from the study.

Statistical Analysis
Numerical data were presented as mean ± SD and categorical data as proportions (%). The qualitative data was expressed by Chi-square test and Student's t-test was used to examine the degree of significance. For statistical analysis, SPSS software version 25 was used. P value was calculated and $P < 0.05$ was considered to be statistically significant**.**

RESULTS
A total of 50 patients were included in study, there was no statistical difference in between the 2 groups with respect to age, gender, weight and type of block given (P>0.05) (Table 1, 2, 3, 4)

Age Group (Years)	Group A		Group B	
	No.	%	No.	%
20-35	15	60%	14	56%
36-50	10	40%	11	44%
Mean	33.76 years		33.20 years	
SD	9.96		9.70	
'p' Value	>0.05 (0.8413)			

Table 1. Age Distribution

Gender	Group A		Group B	
	No.	%	No.	%
Male	19	76%	20	80%
Female	6	24%	5	20%

Table 2. Gender Distribution

Weight	Group A		Group B	
	No.	%	No.	%
35-50	15	60%	14	56%
51-65	10	40%	11	44%
Mean	50.40 kg		51.20 kg	
SD	6.76		6.50	
p Value	>0.05 (0.6716)			

Table 3. Weight Distribution

Type of Block	Group A		Group B	
	No.	%	No.	%
Inter-Scalene Block	6	24%	8	32%
Supra-Clavicular Block	19	76%	17	68%

Table 4. Types of Blocks Given in Two Groups

The mean dose of lignocaine given in the group A is 201.60 ± 27.03 mg and in group B the mean dose is 188.96 ± 29.51 mg with 'p' value of 0.1209 which is not significant

even after 10 patients received reduced dose of lignocaine by 20% in group B (Table - 5).

Time	Group A		Group B		p Value
	Mean	SD	Mean	SD	
Dose of Lignocaine (mg)	201.60	27.03	188.96	29.51	0.1209

Table 5. Comparison of Dose of Lignocaine Given in Both Groups

The mean dose of bupivacaine given in the group A is 100.80 ± 13.52 mg and in the Group B is 94.08 ± 14.79 mg with 'p' value of 0.1001 which is not significant even after dose reduction of 20% in 10 patients in group B (Table – 6).

Time	Group A		Group B		p Value
	Mean	SD	Mean	SD	
Dose of Bupivacaine (mg)	100.80	13.52	94.08	14.79	0.1001

Table 6. Comparison of Dose Bupivacaine Given in Both Groups

The mean onset of sensory blockage was 13.49 ± 1.70 minutes in group A and 8.56 ± 0.95 minutes in group B. There was statistically significant difference in onset of sensory block between two groups (p<0.0001) (Table – 7).

Time	Group A		Group B		p Value
	Mean	SD	Mean	SD	
Onset of Sensory Block	13.49	1.70	8.56	0.95	<0.0001

Table 7. Assessment of Sensory Block

The mean onset of motor blockage was 15.96 ± 1.56 minutes in group A and 10.62 ± 1.08 minutes in group B. There was statistically significant difference in onset of motor block between two groups (p<0.0001) (Table – 8).

Time	Group A		Group B		p Value
	Mean	SD	Mean	SD	
Onset of Motor Block	15.96	1.56	10.62	1.08	<0.0001

Table 8. Assessment of Motor Block

Out of 25 patients, 4 patients in group A had block failure while only 1 patient out of 25 patients in group B had block failure. 5 patient needed supplemental analgesia in group A in compare to only 1 patient needed in group B. While 4 patient had blood aspiration while performing block in group A while no patient had blood aspiration while performing block under USG guidance in Group B (Table – 9).

Complication	Group A		Group B	
	No.	%	No.	%
Block Failure	4	16%	1	4%
Supplemental Analgesia	5	20%	1	4%
Pneumothorax	0	0%	0	0%
Blood Aspiration	4	16%	0	0%

Table 9. Comparison of Complication Between the Two Groups

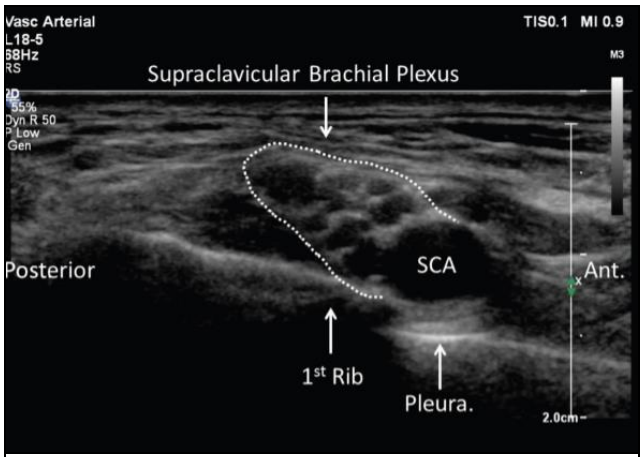

Figure 1

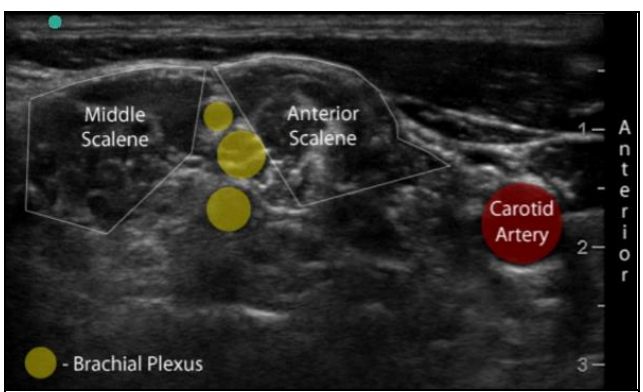

Figure 2

DISCUSSION

Supraclavicular block provides dense anaesthesia of upper limb and was described as the "spinal of the arm". 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[12]. But landmark technique is associated with high failure rate and unacceptable high rates of complications like pneumothorax. Due to these, use of supraclavicular brachial plexus fell out of favour. With introduction of ultrasound imaging for regional nerve block[13,14] this technique has seen resurgence in recent years. The present study was undertaken to evaluate the success ratio of blocks given with either conventional method or USG guided block. We selected supraclavicular and inter scalene approach of the ease of administration, higher success rate, more reliable and denser blockage of all three trunks[15]. Moreover, there is no sparing of musculocutaneous nerves and axillary nerve and incidence of tourniquet pain is less. In our study, out of the 50 participants, 25 were given block with conventional method and 25 were given USG guided brachial plexus block. The groups were comparable with respect to age, gender, weight and type of block. In our study, we have given reduced dose of local anaesthetic by 20% compared to dose needed according to their weight to the patients who received ultra-sonography guided block and we achieved the satisfactory level of anaesthesia. These findings are consistent with Mohamad M. A. et al,[16] who in their study found that reduced dose of local anaesthetic can be used in ultrasound guided ISB

in combined with SCB to give satisfactory level of anaesthesia to entire length of the arm. Dose reduction in local anaesthetic can help to reduce the chances of local anaesthetic toxicity and helps to maintain the hemodynamic stability in high risk patients. In our study, we found that there was reduction in onset time of sensory and motor block in USG group[17,18]. Similarly, P. F. Soeding et al[19] conducted the study of 40 patients and found that ultrasound guidance reduces the onset time and improves the quality of both sensory and motor block. In our study the success rate of 96% in USG group and 94% in conventional group. our finding are consistent with pearl et al who conducted the study of 510 case of USG guided SCB in regards to success rate and found that surgical anaesthesia was achieved in 94.6% of patients after a single attempt. In our study no patient had the complication of pneumothorax[20] while performing the block in both the groups. While 16% of the patients had block failure and blood aspiration in group A, while no patient had blood aspiration and only one patient (4%) had block failure in group B. In group A 20% of of patient needed supplemental analgesia during the procedure while only 1 patient (4%) needed supplemental analgesia in group B.

CONCLUSIONS

Use of USG machine to perform the block causes faster onset of sensory and motor blockage due to real time visualization of needle. It also decreases the failure rate of the block and decrease the chances of complications. Use of USG can help to reduce the dose of local anaesthetic to achieve the surgical anaesthesia and analgesia.

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