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Original Research Article

To Evaluate Different Doses of Lignocaine and Bupivacaine Combination for Ultrasonographic Guide Supraclavicular Brachial Block

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Abstract:

Background: Regional anaesthesia is an effective technique to relieve pain in upper limb surgery. For upper extremity surgeries, Brachial plexus block, supraclavicular approach is the easiest and the most commonly used method. Local anaesthetics, lignocaine and bupivacaine for ultrasound guided in two different doses (20ml and 30ml) are used to provide analgesia.

Aim and Objectives: To evaluate the efficacy and the onset and duration of sensory and motor block with lignocaine and bupivacaine for ultrasound guided supraclavicular brachial plexus block in two different doses (20ml and 30ml) and to assess hemodynamic stability and occurrence of side effects and complications.

Materials and Methods: This observational hospital-based study was conducted on 60 patients of either sex aged between 18-60 years with ASA status I or II scheduled for elective surgeries under supraclavicular block. The patients were randomly divided into two groups of 30 each .Group A patients received 0.5% bupivacaine (10ml) + 2% lignocaine (10ml).Group B Patients received 0.5% bupivacaine (15ml) + 2% lignocaine (15 ml) Descriptive statistics was done and were reported in terms of mean, standard deviation and percentages.

Results: The mean heart rate in group A was 76.97±6.19 and in Group B it was 76.80±6.16. Mean Arterial Pressure (MAP) in Group A was 91.69±3.51 and in Group B it was 91.68±3.36.The mean onset of sensory and motor blockade was found statistically significant($p<0.05$) which means that it takes higher time for onset of blockade with low volume 20ml in group A when compared with Group B. The mean Duration of Sensory Block in group A and group B was 271.67±51.60 minutes and 287.00±42.28 minutes respectively whereas the mean Duration of Motor Block was 245.00±53.74 min and was 270.67±42.18 minutes. The mean duration of motor block was significantly higher in group B as compared to group A.

Conclusion: The application of USG guided supraclavicular brachial block can be considered sufficient to be able to provide similar duration of sensory block with 20ml combination of lignocaine and bupivacaine when compared with 30ml of same drug.

Keywords: Bupivacaine, Lignocaine, Supraclavicular Brachial Plexus.

Introduction

Pain is an unpleasant sensation and is always underestimated. Pain relief is an important aspect during and after surgery [1]. Regional anaesthesia is an effective technique to relieve pain in upper limb surgery. This technique includes the application of a local anaesthetic agent to a nerve trunk. [2] It provides good intra operative and prolonged post-operative relief from pain.

For upper extremity surgeries, Brachial plexus block is the most commonly used method. In 1889 William Stewart Halsted did first brachial plexus block. In 1911, Kulenkampff introduced the classical supra clavicular approach of brachial plexus block [3]. Supraclavicular approach is the easiest and most effective method of brachial plexus block. The blind technique approach using paraesthesia for supraclavicular brachial plexus block is associated with injury to nerve, vascular structures, pleura and associated with high failure rate. To avoid these problems the use of ultrasound guided brachial plexus block came into existance.

The local anaesthetic agent Lignocaine(plane) 2%, have been used in this study due to its rapid onset(3min), intense and immediate duration of anaesthesia. The local anaesthetic agent Bupivacaine (plane)0.5%, have also been used due to its long duration of action(3-8hrs) and adequate postoperative pain relief without significant motor blockade.

Ultrasound guided technique provide us the real time imaging guidance for the procedure [4]. During the advancement of needle, it gives the proper visualisation of needle ,therefore repositioning of needle in case of maldistribution of local anaesthetic agents can be possible .The use of large volume of local anaesthetic agents for brachial block may be associated with high risk of toxicity and other complications . So the use of USG can improves the success rate, reduces the dosage of local anaesthetic & devoid of complications.

With the use of ultrasound guidance, the volume of LA can significantly be reduced when brachial plexus block is performed. The dose reduction can be advantageous from a safety perspectives but ultrasound guided supraclavicular brachial block requires technical skills otherwise would lead to number of needle pricks and needle readjustments which may be felt discomfort to the patient therefore it requires the expertise for ultrasound guided brachial plexus block also the cost is the limiting factor [5].

The present study was done to evaluate the efficacy and the onset and duration of sensory and motor block with lignocaine and bupivacaine for ultrasound guided supraclavicular brachial plexus block in two different doses (20ml and 30ml) and to assess hemodynamic stability and occurrence of side effects and complications if any.

Material and Methods

This prospective and observational hospital based study was conducted on 60 patients, 30 in each group, at department of Anesthesia in Gandhi Medical College and associated hamidia Hospital, Bhopal, India. After approval by Institutional Ethics Committee, written informed consent was obtained from all the patients in their own vernacular language.

Inclusion Criteria:

1. ASA physical status I & II undergoing elective upper limb surgeries
2. Patients aged between 18 and 60 years old
3. Weight above 40 kg.

Exclusion Criteria:

1. Patient refusal
2. Allergy to Local anaesthetics and opioids
3. Patients below 17 and above 60 years of age
4. Local infection at the site of block
5. pregnant women
6. Severe cardiopulmonary disease
7. Patients with Neurological deficit in operating arm
8. Bleeding disorders/ Patients on anticoagulants
9. Lactating mothers.
10. Hepatic, renal or cardiopulmonary abnormality
11. ASA 3-4
12. Patients who needed or converted to general anaesthesia after unsuccessful block or block failure.

Procedure:

60 patients will be randomly divided in following two groups: **Group A** (n=30) and **Group B** (n=30)

Group A patients received 0.5% bupivacaine (10ml) + 2% lignocaine (10ml)

Group B Patients received 0.5% bupivacaine (15ml) + 2% lignocaine (15 ml)

After pre-anaesthesia checkup and routine investigations, a common standard anaesthetic regimen will be followed for all the patients which will include overnight fasting prior to surgery and lignocaine sensitivity test will be done. The procedure was explained to the patient in detail.

All the patients were premedicated with drug Inj.Ranitidine 50 mg and Inj. Ondensetron 8 mg prior to the surgery. On arrival of patients to the operating room monitors like pulse oximeter, non-invasive blood. pressure and ECG were connected and the baseline values of the patient were recorded. Intravenous (i.v) infusion of Ringers' lactate started and oxygen given at 3 L/min through a face mask. An 18G intravenous cannula was inserted in the contralateral forearm and an IV infusion started. All emergency drugs and intubation kits were kept ready for emergency resuscitation of patient.

Patients were placed Supine, arm abducted at the level of shoulders at 90 degrees & the elbow flexed at 90 degrees as well. Ultrasound machine is positioned to the opposite side of the patient, from where the nerve block is being placed.

Local infiltration of 2ml of 1% lignocaine was given at the puncture site. This procedure was done by using ultrasound machine with 13-6 MHz

transducer by in-plane approach using 22G, 100mm needle. Ultrasound machine & probe were prepared for the procedure under all aseptic precaution Here, block was performed after visualising the arteries and veins in real time, nerves as well as bones with "in-plane approach". This procedure was done with ultrasonogram machine having 15-6 MHz probe by the "in-plane approach" with 15 cm long, 22gauge short bevel insulated stimulating needle**.** The patient was positioned as mentioned above. After sterile preparation of the site, draping was done.

The brachial plexus and its spatial relationship to surrounding structures were scanned after the patients received IV access and routine anaesthesia monitoring.

With the patient lying supine and the head turned 45° to the contralateral side, the ultrasound probe was placed in the coronal oblique plane in the

supraclavicular fossa to visualize the subclavian artery and brachial plexus in the transverse sectional view (i.e., at approximately 90°). The brachial plexus, a cluster of hypoechoic nodules, was often found lateral to the round pulsating hypoechoic subclavian artery lying on top of the hyperechoic first rib. Once brachial plexus is located **Group A** received 0.5% bupivacaine (10ml)+ 2% lignocaine(10ml) and **Group B** received 0.5% bupivacaine (15ml) + 2% lignocaine (15ml) over 2-3 minutes using inplane approach. During the procedure and thereafter ,the patient was observed vigilantly for any complications of the block and for the toxicity of the drugs injected.

Parameters Observed

Assessment of Parameters:

1. Onset of sensory blockade: It is defined as the time interval between the end of local anaesthetic administration and complete loss of sensation to pain (Grade 2). It was assessed by pinprick test along the distribution of each nerve with a needle using the 3 point scale for pain. The scale is described as

Grade 0 = normal sensation or no change in sensation

Grade 1 = loss of sensation of pin prick /Dull pain (analgesia)

Grade 2 = loss of sensation of touch/ No pain (anaesthesia)

and compared to same stimulation on contralateral arm.

2. Onset of motor blockade: It is defined as the time interval between the local anaesthetic administration and complete motor block (Grade 2). It was assessed according to Modified Bromage Scale. The grades of Bromage scale are as follows

Grade 0 - Normal motor function with full flexion and extension of elbow, wrist and fingers.

Grade 1 - Decreased motor power with the ability to move the fingers only.

Grade 2 - Complete motor block with inability to move the fingers.

3. Duration of sensory blockade: It was defined as the measured time interval between the complete sensory block to the complete resolution of anaesthesia on all the nerves (Score 0).

4. Duration of motor blockade: It was defined as the measured time interval from complete motor block to complete recovery of motor function of hand and forearm (Grade 0 of Modified Bromage Scale).

5. Vitals parameters: Heart rate and blood pressures were recorded before the procedure and immediately after the supraclavicular block, then at 2 minutes interval for first 5 minutes, later at 5 minute for next 10 minutes then at every 15 minutes interval till completion of the surgery, the last reading was taken 10 minutes after the procedure. Postop Bp and Heart rate were measured every two hrs until 24hrs.

6. Complications: Patients were watched intraoperatively and 24 hours postoperatively for complications.

Intraoperative complications: Vessel puncture and hematoma formation, any toxic or allergic reaction to the drug .Postoperative complications: Nerve Injury, pneumothorax, hematoma, systemic toxicity.

All the patients were administered with supplemental oxygen and intravenous fluids throughout the operative procedure. Heart rate, non-invasive blood pressure and oxygen saturation were monitored and recorded at 0,1,3, 5, 10, 15, 30, 45, 60,75, 90,105, 120 minutes. All patients were monitored for 24 hours post-operatively.

Statistical Analysis: The data was analysed using Statistical Package for Social Sciences software (SPSS) version 22.0 and Microsoft excel. Descriptive statistics was done for all data and were reported in terms of mean, standard deviation and percentages. Appropriate statistical tests of comparison were applied. Categorical variables like age, gender were analysed with the help of Chi-square test . Continuous variables like analysed with Student's t-test and Mann Whitney U test. The p-value of <0.05 was taken as statistically significant and <0.001 was taken as highly significant.

Results

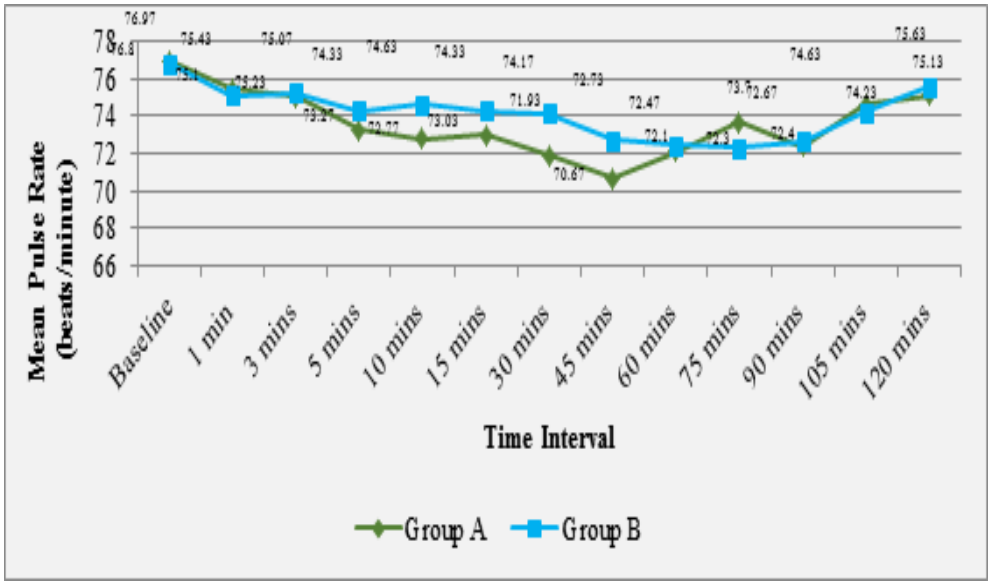
Demographic parameters:

Demographic profile was comparable in terms of age, sex, weight, and ASA physical status in both groups .Both the groups were comparable and statistically non- significant (p-value >0.05) [Table 1].

Table 1: Patient characteristics

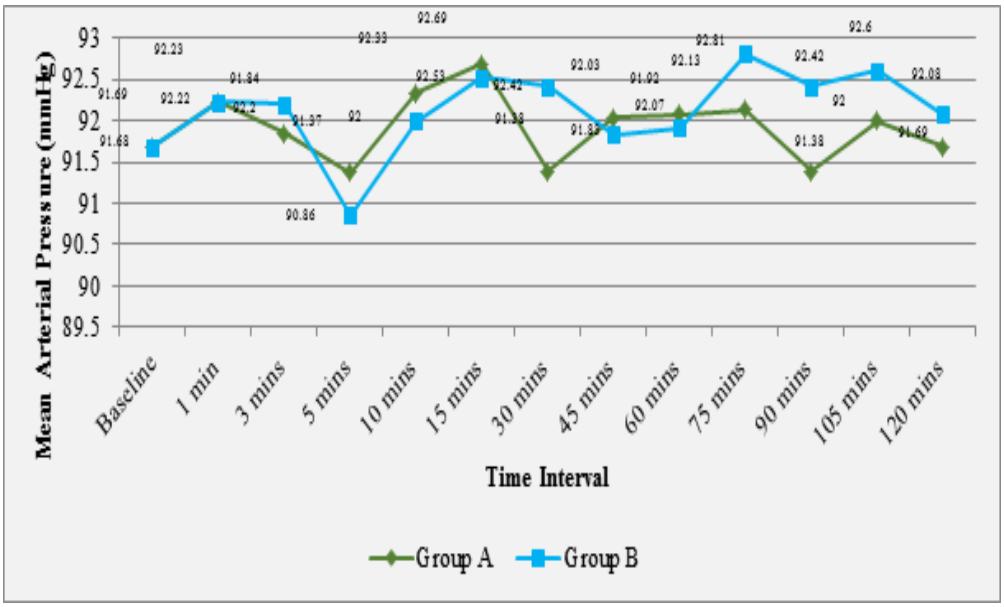
Patient characteristics	Group A	Group B	p value
Age (years)	31.97±10.31	34.20±9.89	p>0.05
Sex (M/F)	17/13	16/14	p>0.05
Weight (kgs)	56.13±4.24	55.10±4.57	p>0.05
ASA 1/2	15/15	13/17	p>0.05

Haemodynamic parameters: The baseline HR, MAP and SpO2 were comparable between both the groups.



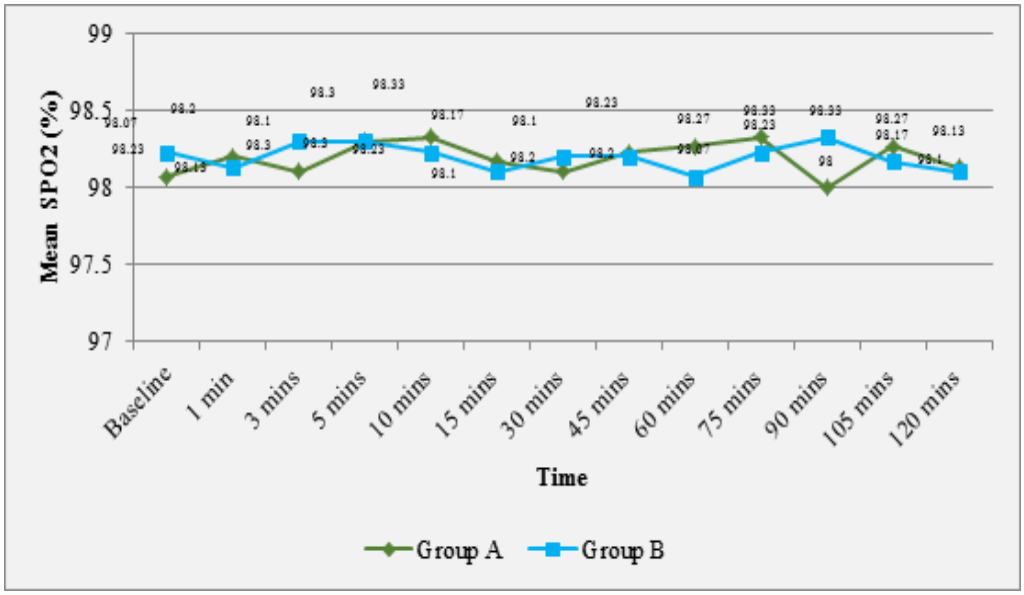
Graph 1: Mean pulse rate

The differences in mean pulse rate was significant (P<0.05) with a higher mean pulse rate in Group B in comparison to Group A at 10 minutes and 30 minutes intervals. The mean comparison among the two groups was statistically not significant (p>0.05), showing a comparable mean pulse rate at baseline, 1 min, 3 min., 5 min., 15 min., 45 min., 60 min., 75 min., 90 min., 105 min., 120 min. interval in both the groups.(graph 1)



Graph 2: Mean arterial pressure

The mean comparison among the two groups was statistically not significant (p>0.05), showing a comparable mean arterial pressure at baseline 1 min, 3 min., 5 min., 10 min., 15 min., 45 min., 60 min., 75 min., 90 min., 105 min., 120 min. interval in both the groups.(graph 2)



Graph 3: Mean Spo2

In Group A and Group B, the mean SpO2 remained stable throughout the study period. The mean SpO2 was comparable between the two groups at all the time intervals (P>0.05).(graph 3)

Onset of sensory block

Table 2: Comparison mean onset of Sensory Block between the two groups

Time	No	Mean±SD	't' value	df	P value
Group A	30	12.87±2.24	3.404	58	0.001*
Group B	30	11.07±1.84			

The mean onset of sensory blockade in group A it was 12.87±2.24 minutes, in group B it was 11.07±1.84 minutes. The above association found to be statistically significant (p<0.05) which shows that there is a difference between the two group means. The mean onset of sensory block was significantly higher in group A compared to group B.(table 2)

Table 3: Comparison of mean onset of Motor Block between the two groups

Time	No	Mean±SD	't' value	df	P value
Group A	30	17.70±2.32	3.995	58	0.000*
Group B	30	14.97±2.94			

The mean onset of motor blockade in group A it was 17.70±2.32 minutes, in group B it was 14.97±2.94 minutes. The above association found to be statistically significant (p<0.05) which shows that there is a difference between the two group means. The mean onset of motor block was significantly higher in group A compared to group B.(table 3)

Table 4: Comparison of mean duration of Sensory Block between the two groups

Time	No	Mean±SD	't' value	df	P value
Group A	30	271.67±51.60	-1.259	58	0.213
Group B	30	287.00±42.28			

The mean Duration of Sensory Block in group A it was 271.67±51.60 minutes, in group B it was 287.00±42.28 minutes. The above association found to be statistically not significant (p>0.05) which shows the duration of sensory block of both groups are comparable. (Table 4)

Table 5: Comparison of mean Duration of Motor Block between the two groups

Time	No	Mean±SD	't' value	df	P value
Group A	30	245.00±53.74	-2.058	58	0.044
Group B	30	270.67±42.18			

The mean Duration of Motor Block in group A it was 245.00±53.74 minutes, in group B it was 270.67±42.18 minutes. The above association found to be statistically significant (p<0.05) which shows that there is a difference between the two group means. The mean duration of motor block was significantly higher in group Bas compared to group A.(table 5)

In **Group A** and **Group B** there were no complication found. The above association found to be statistically not significant (p>0.05) which shows the complications of both groups are comparable.

Discussion

Supraclavicular brachial plexus block under ultrasound guided are nowadays commonly used for upper limb surgeries as an alternative to general anaesthesia as it ensures ideal operating conditions with stable intra operative haemodynamic parameters, adequate pain control, post op analgesia, less financial burden, early recovery & reduced side effects. In the present study we have been tried to evaluate the two different dose of local anaesthetic agents in combination of lignocaine plane 2% and bupivacaine plane 0.5% and tried to observe that the use of less dose of local anaesthetic agents have been equally effective for usg guided supraclavicular brachial block for upper limb surgeries.In studies like Duggan et al. [12] found, that the minimum effective anaesthetic volume in50% and 95% of patients (n:21) was 23 mL and 42 mL of 50:50 mixture of lidocaine 2% and bupivacaine 0.5% with epinephrine. Recently, Ferraro et al. [13] determined the minimum effective volume in 90% of patients (n:19) of 0.5% bupivacaine with epinephrine as 1.56mL per nerve for axillary brachial plexus block. Sivashanmugam also used the 1:1 mixture of 2% lidocaine with epinephrine and 0.5% bupivacaine at 0.5 ml/kg for brachial plexus blockade Sivashanmugamet al. [14]

This study aimed to determine whether the low dose of LA could provide surgical anaesthesia when applied as supraclavicular brachial plexus nerve block under USG guidance, as the amount of LA was decreased, the time to onset of the block was observed to be prolonged, the time to recovery of the block was shortened, and the duration of the block was shortened.

We observed that there was no significant difference in demographic parameter between both the groups regarding their underlying variables such as Gender, Age, Weight and ASA status; Similar result were also observed in following studies done by Alfred V M (2018) [5] and in Krishna C et al (2016) [3] in which age ,sex and weight were not significant .

Hemodynamic Parameters: In present study ,the baseline mean pulse rate in Group A was 76.97±6.19 and in Group B it was 76.80±6.16. The mean comparison of heart rate among the two groups was statistically not significant (p>0.05) at baseline and throughout the intraoperative period as is observed in study done by Alfred V M (2018) [5] , Almasi R et al (2020) [6] in which changes in heart was as not statistically significant (p >0.05).

In present study, we observed that the baseline mean Arterial Pressure in Group A was 91.69±3.51 and in Group B it was 91.68±3.36, we observed that the mean arterial pressure among the two groups was found statistically insignificant(p>0.05) at baseline and throughout the intraoperative interval in both the groups . Study done by Almasi R et al (2020) [6] also found that statistically insignificant.

In Group A and Group B, the mean SpO2 remained stable throughout the study period. We observed that the baseline SpO2 in Group A was 98.07±0.69 and in Group B it was 98.23±0.68, The mean SpO2 was comparable between the two groups at all the time intervals (P>0.05), similarly observed in study done by Salwa H Waly et al [11]

Onset of Sensory and motor block: In the present study, we observed that the mean onset of sensory blockade in group A and group B was 12.87±2.24 minutes and 11.07±1.84 minutes respectively. The above association found to be statistically significant (p<0.05).The mean onset of sensory block was significantly higher in group A compared to group B. The mean onset of motor blockade in group A it was 17.70±2.32 minutes, in group B it was 14.97±2.94 minutes. The above association was found to be statistically significant (p<0.05) which shows the mean onset of motor block was significantly higher in group A compared to group B.

Erdogmus N et al (2021) [7] also observed that in the comparison of the time of onset of sensory and motor block it was longest in the patients applied with the lowest volume of 6.0 ml of local anaesthetic (LA) the mean onset of sensory block was 25.0±9.4 min and mean onset of motor block was 26.0 ±9.6 min, and this difference was statistically significant.

The onset of motor block was within 16.06 ± 4.49 min in Group Aand 14.9 ± 3.62 min in Group B. This was not statistically significant. In the study done by Alfred et al [5] observed that the mean onset time of sensory and motor block was found to be significantly shorter in Group A ultrasound (12.83 ± 3.640 min and 23 ± 4.275 min, respectively) when compared with Group B nerve stimulator (16 ± 3.572 min and 27 ± 3.851 min, respectively).Similarly observed by Ratnawat *et al*. [8] in which the mean onset time of sensory and motor block was significantly shorter in USG group (6.46 ± 1.02 min and 8.10 ± 1.02 min, respectively) compared to the PNS group (7.68 ± 1.33 min).

In our study the mean onset of sensory and motor blockade was found statistically significant(p<0.05) which means that it takes higher time for onset of blockade with low volume 20ml in group A when compared with Group B 30ml under ultrasound guided supraclavicular brachial plexus block this could be due to low volume of local anaesthetic drugs used.

Duration of Sensory and Motor Block: In our study the mean Duration of Sensory Block in group A and group B was 271.67±51.60 minutes and 287.00±42.28 minutes respectively. The above was association found to be statistically not significant ($p>0.05$) whereas the mean Duration of Motor Block was 245.00±53.74 min and was 270.67±42.18 minutes which shows that there is a difference between the two group means. The mean duration of motor block was significantly higher in group B as compared to group A. Similarly observed by Ratnawat *et al*. [8] who observed a significantly prolonged duration of sensory and motor block in USG group (8.13 ± 1.63 h and 7.13 ± 1.63 h respectively) than the PNS group (6.14 ± 2.36 hand 5.14 ± 2.36 h, respectively, Duncan *et al*. [9] observed that both the USG and PNS groups had comparable mean duration of sensory and motor with 1:1 mixture of 0.5% bupivacaine and 2% lignocaine with 1:200,000 adrenaline, but in study done by honnavar et al [10] Duration of sensory blockade in Group US was more than Group C. and Duration of motor blockade was not statistically significant in both groups.

Complication

There were no complications observed in either group in our study. The association was found to be statistically not significant ($p>0.05$) which shows the complications of both groups are comparable. Study done by Alfred et al [5] also observed that there was no incidence of complications such as arterial puncture, pneumothorax and nerve injury in both the groups was observed. Whereas in study done by Erdogmus N et al [7] observed arterial puncture in two patients rest no other complications were observed.

Conclusion

As per the results and observations found in our study we concluded that the application of USG guided supraclavicular brachial block can be considered sufficient to be able to provide similar duration of sensory block with 20ml combination of lignocaine and bupivacaine when compared with 30ml of same drug with no incidence of complications with the ultrasound guided techniques during supraclavicular block in our study in either group. However, it has been observed that at this volume(20ml), the time to onset of the sensory and motor block is prolonged, the time of motor block recovery is shortened. Therefore there is a need of further studies to show that the sufficient surgical anaesthesia could be provided at lower doses with ultrasound guided supraclavicular block technique

Limitation of study: The present study had the following limitations:
1) Small sample size in this study which included only adult patients might affect the study conclusion.
2) We were unable to detect adverse reactions in patients due to the small sample size.

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