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COMPARATIVE EVALUATION OF THE EFFICACY OF LEVOBUPIVACAINE AND ROPIVACAINE WITH DEXAMETHASONE AS AN ADJUVANT, IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR ORTHOPEDIC UPPER LIMB SURGERIES

Anaesthesiology

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ABSTRACT

Background: Brachial plexus block utilizing ultrasound imaging has now become either adjuvant to general anesthesia (GA) or as a mainstay anesthesia modality. Supraclavicular brachial plexus block is the easiest, the most consistent and time efficient method of brachial plexus block being performed at division level and close to ideal anesthetic technique for providing excellent intraoperative and postoperative pain relief. Objectives: To study and compare the efficacy of sensory and motor analgesia and anesthesia, in ultrasound guided supraclavicular brachial plexus block using 0.5% levobupivacaine and 0.5% ropivacaine and dexamethasone 8 mg added as an adjuvant to both the groups. **Material and Methods:** 60 ASA I - II patients aged between 20-60 years of either sex scheduled for surgeries of forearm and hand were included in the study and randomly divided into 2 groups of 30 patients each. Ultrasound guided Supraclavicular block was performed with 0.5% levobupivacaine and 0.5% ropivacaine with dexamethasone in each group. Patients were evaluated for sensory and motor characteristics of the block (onset and duration), duration of post-operative analgesia, side effects if any and need for rescue analgesia in 24 hours. **Results:** The study shows that there was statistically significant difference in onset of sensory and motor block between Levobupivacaine and Ropivacaine (6.4±1.77 min vs 8.5±1.87 min) and (10.7±2.70 min vs 19.1±6.66 min) respectively. The duration of analgesia was longer in Levobupivacaine group (24.9 ± 0.74 hours) as compared to Ropivacaine (21.5 ± 3.95 hours).**Conclusion:** To conclude the study, we observed Levobupivacaine 0.5% having better profile in comparison to ropivacaine 0.5%in having faster onset of sensory and motor blockade, prolonged duration of sensory and motor blockade, prolonged duration of post-operative analgesia, Levobupivacaine should thus be considered for peripheral nerve block when postoperative analgesia is a concern but not when an early return of motor function is desired in postoperative period for upper limb elective surgeries.

KEYWORDS

Brachial plexus block, levobupivacaine, dexamethasone, ropivacaine, upper limb, Ultrasound imaging

INTRODUCTION

The supraclavicular approach to the brachial plexus results in faster onset and complete block, as it can be given at distal trunks where it is most compact throughout the plexus (1, 2). Introduction of ultrasound guidance (USG) has led to enhanced visualization of brachial plexus anatomy, needle placement, and perineural dispersion of localanesthetic, lessening the requirement of local anesthetic and thus decreasing the risk of complications associated with local anesthetic systemic toxicity(3). The levorotatory S (-) isomers of bupivacaine has been shown to have a safer pharmacological profile with less cardiac and neurotoxic adverse effects. Ropivacaine, the S-enantiomer of S-1-propyl-2, 6 –pipecoloxylidide, is the stereoisomer of bupivacaine and has been shown in earlier animal studies to have less central nervous system toxicity and less cardiotoxicity than bupivacaine (5). Recent research has focused on the addition of the glucocorticoid dexamethasone as a local anesthetic adjuvant in regional anesthesia. It has been suggested that dexamethasone may prolong block duration by increasing the activity of inhibitory potassium channels on nociceptive C fibers or by causing vasoconstriction via glucocorticoid receptor mediated nuclear transcription modulation (6, 7, 8). The present study was undertaken to compare and evaluate the efficacy and safety of Levobupivacaine and Ropivacaine with dexamethasone added as an adjuvant in both the groups in ultrasound guided supraclavicular brachial plexus block for an orthopaedic upper limb surgery.

Material and Methods

The present study was conducted in the Postgraduate Department of Anaesthesiology and Intensive Care, Government Medical College Jammu after obtaining approval from the hospital ethical committee on 60 ASA I - II patients aged between 20-60 years of either sex scheduled for surgeries of forearm and hand. Written informed consent was obtained preoperatively from the patients. Patients with known hypersensitivity or contraindication to study drugs, infection at the site of block, known coagulopathy or patient on anticoagulants, severe renal, hepatic, respiratory, cardiac disease, morbidly obese patients (BMI > 35 kg/m2), neurological, psychiatric or neurovascular disorders, pregnant females, preexisting contralateral hemidiaphragmatic paralysis, patients less than 15 years and more than 60 years of age and those who refused the procedure were excluded from our study. Patients were randomly divided into 2 groups of 30 patients each. Group L received 28ml 0.5% levobupivacaine and 2ml (8mg) dexamethasone. Group R received 28ml 0.5% ropivacaine and 2ml (8mg) dexamethasone.

All patients were premedicated with ondansetron 4 mg I/V. After arriving in the operating room, intravenous access with 18 G intravenous cannula was established in the non-operative limb and an infusion of Ringer lactate was started. A multiparameter monitor with echocardiogram, pulse oximetry, and noninvasive blood pressure was attached and base line parameters were recorded. Local anaesthesia was given with 1% lignocaine (3 ml) using 26 G needle at a site 1 cm superior to the mid-clavicular point just lateral and posterior to subclavian pulsation. The supraclavicular block was performed by a USG machine, Mindray DC-70 Exp. By in-plane technique, UAAP, once the needle pierced the brachial plexus cluster, the anesthetic mixture was administered, according to the respective groups, i.e. Group L received 23ml 0.5% levobupivacaine and 2ml (8mg) dexamethasone and Group R received 23ml 0.5% ropivacaine and 2ml (8mg) dexamethasone to a total volume of 25 ml in each group. End of the injection was considered as time zero.

Patients were evaluated for sensory and motor characteristics of the block (onset and duration), and side effects if any till the effect was over. Hemodynamic variables of the patient were monitored at 1, 5 and 10 minutes and then every 10 minutes till the completion of the surgery.Sensory block was assessed by pin prick method and compared with the same stimulation in the contralateral control arm.

0 sharp pain
1 touch sensation only
2 Not even touch sensation

Sensory score of 2 was taken as the time of onset of sensory block.

Motor block was assessed by using MODIFIED BROMAGE SCALE for upper extremity:

0 Patient is able to raise the extended arm to 90 degrees for 2 seconds.
1 Patient is able to flex the elbow and move the fingers but unable to raise the extended arm.
2 Patient is unable to flex the elbow but able to move the fingers.

3 Patient is unable to move the arm, elbow and the fingers.
Motor score of 3 was taken as the onset time of complete motor block. After confirming adequacy of block, patient was sedated with inj. Midazolam 0.03 mg/kg i/v and surgery was allowed to proceed. Duration of pain relief was noted till a visual analogue score of >= 4 (0: being no pain and 10: being unbearable pain) was reached. Patients at that time was given rescue analgesia in the form of Inj. Ketorolac 30 mg i/m stat. The number of patients receiving rescue analgesia in 24 hours in both the groups were noted.

Patients in whom block failed were excluded from the study.

STATISTICAL ANALYSIS: Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were summarized in the form of means and standard deviations and categorical variables were summarized as percentages. Analysis of variance test (ANOVA) was employed for inter group analysis of data and for multiple comparisons, Bonferroni post hoc test was applied. Chi-square test was used for comparison of categorical variables. Graphically the data was presented by bar and line diagrams. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

RESULTS

Table 1: Mean demographic and baseline haemodynamic parameters of patients.

Demographics and haemodynamic parameters	Group L Mean ± SD	Group R Mean ± SD	P-value
Age (years)	32.3 ± 13.79	31.9 ± 12.25	0.085
Weight (kg)	61.3 ± 5.64	60.1 ± 5.54	0.527
Systolic blood pressure (mmHg)	121.5 ± 6.64	120.9 ± 4.99	0.758
Diastolic blood pressure (mmHg)	77.9 ± 6.73	76.7 ± 8.12	0.827
Mean Arterial pressure (mmHg)	92.4 ± 5.82	91.4 ± 6.30	0.817
Heart rate (beats/min)	81.4 ± 4.82	82.6 ± 5.81	0.502
Oxygen saturation (%)	98.60 ± 0.50	98.60 ± 0.50	0.960

*Statistically Significant Difference (P-value<0.05), $: P-value by Analysis of variance (ANOVA)

Both the groups were comparable in patient demographics i.e. age, sex and weight and also the duration of surgery with no statistical difference.

Table 2: Mean onset of sensory and motor block (minutes) in both groups

Sensory block					Motor block			
Group	Mean	SD	Range	P-value$	Mean	SD	Range	P-value$
Group L	6.4	1.77	4-12	0.002*	10.7	2.70	8-20	<0.001*
Group R	8.5	1.87	6-12		19.1	6.66	10-30	

*Statistically Significant Difference (P-value<0.05), $: P-value by Analysis of variance (ANOVA)The mean onset of sensory and motor block was 6.4±1.77 minutes and 10.7±2.70 minutes in group L and 8.5±1.87 minutes and 19.1±6.66 minutes in group R respectively. The above observations were found to be statistically significant by ANOVA test (p value < 0.05).

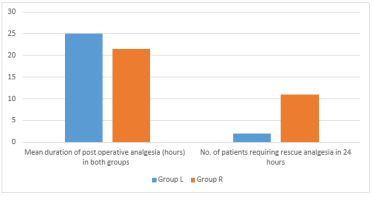
Table 3: Mean duration of sensory and motor block (minutes) in both groups

Sensory					Motor			
Group	Mean	SD	Range	P-value$	Mean	SD	Range	P-value$
Group L	21.8	1.22	20-24	<0.001*	22.9	1.01	22-24	<0.001*
Group R	15.5	2.03	10-20		12.9	2.27	6-18	

*Statistically Significant Difference (P-value<0.05), $: P-value by Analysis of variance (ANOVA)

The mean duration of sensory and motor block was 21.8±1.22 hours and 22.9±1.01 hours in group L and 15.5±2.03 hours and 12.9±2.27 hours in group R respectively. The above observations were found to be statistically significant by ANOVA test (p value < 0.05).

Fig. 1: Mean duration of postoperative analgesia in hours and number of patients requiring rescue analgesia in 24 hours in both groups.



The mean duration of postoperative analgesia was 24.9 ± 0.74 hours in group L and 21.5 ± 3.95 hours in group R. Duration of postoperative analgesia i.e. patient's first request to rescue analgesic was significantly prolonged in group L as compared to group R and the difference was statistically significant (p value < 0.05).

The rescue analgesia used was inj. Ketorolac 30mg I/m stat. 6.7%, i.e. 2 patients required rescue analgesia in group L and 36.7%, i.e. 11 patients required rescue analgesia in group R. The difference in these groups was found to be statistically significant (p value < 0.05).
There were no significant side effects and complications noted in our study.

DISCUSSION

Supraclavicular Brachial plexus block forms the multipurpose and dependable local anesthetic technique and an appropriate substitute to general anesthesia for upper limb surgery. Both the groups in our study were comparable in patient demographics i.e. age, sex and weight and also the duration of surgery with no statistical difference between both the groups as shown in table 1. In this study group L showed faster onset of sensory (6.4±1.77 min) and motor block (10.7±2.70 min) as compared to group R (8.5±1.87 min and 19.1±6.66 min respectively) as shown in table 2. This was in accordance with a study done by Kulkarni SB et al (10) who observed that the mean onset of sensory and motor block was significantly rapid in group L as compared to group R. Similar results were observed by Piangatelli C et al (11) and Mageswaranand Choy (12). On the contrary, our study did not match with that of Mankad P P et al (13) who concluded that onset of motor blockade was significantly faster with ropivacaine as compared to levobupivacaine (P < 0.05). The difference in observations may be attributed to the technical procedure used, as they used peripheral nerve stimulator. Nodulas et al (14) found that both 0.5% Levobupivacaine and 0.5% ropivacaine had similar onset of action.

The mean duration of sensory and motor block was 21.8±1.22 hours and 22.9±1.01 hours in group L and 15.5±2.03 hours and 12.9±2.27 hours in group R respectively as shown in table 3. This statistically significant (p value < 0.001) difference was similar to that found by Cline E et al (15) who concluded that levobupivacaine should be considered when post-operative analgesia is the concern but not when an early return of motor activity is required. This observation is similar to the results of Casati et al (16). Similarly in the study conducted by Deshpande et al, (17) they found the onset of sensory and motor block early with levobupivacaine. The duration of sensory, motor block and postoperative analgesia was prolonged with levobupivacaine as compared to 0.5% ropivacaine in supraclavicular brachial plexus block. A study in contrast to ours was conducted by Liisanantti O et al, (18) who found that the duration of motor block and sensory block was prolonged for ropivacaine when compared with levobupivacaine. This difference could possibly be because of the higher concentration of study drugs used by them.

Study by Pathak RG et al, (19) concluded that addition of dexamethasone to local anaesthetic drugs in brachial plexus block significantly prolongs the duration of analgesia, motor block, reduces the requirement of rescue analgesia in post-operative period but has no effect on the onset time of sensory and motor blockade in patients undergoing upper limb surgeries and is remarkably safe and cost

effective method of providing post-operative analgesia. This prompted us also to use a dose of 8 mg dexamethasone in both the groups. It has been suggested that dexamethasone may prolongblock duration by increasing the activity of inhibitory potassium channels on nociceptive C fibers (22) or by causing vasoconstriction via glucocorticoid receptor mediated nuclear transcription modulation (23). The suppression of inflammatory mediators, including prostaglandins (PGE2), by dexamethasone may also play a role. Indirect evidence has supported the assumption that dexamethasone acts locally.

The mean duration of postoperative analgesia was significantly prolonged in group L as compared to group R as shown in fig 1. Our study was similar to the studies conducted by Piangatelli C et al (11), Cline et al (15) and Fournier et al (20). Although Gonzalez-Suarez et al, (21) found that the duration of analgesia was seen to be prolonged more with ropivacaine than with levobupivacaine. It could probably be attributed to the lower concentration of levobupivacaine used in their study i.e. 0.25% levobupivacaine was used.

Patients in both the groups were given rescue analgesia in the form of injection ketorolac 30 mg I/m stat whenever the VAS score was more than 4. 6.7% of patients required rescue analgesia in group L and 36.7% in group R shown in fig 1 and the difference being statistically significant (p value < 0.001). Cline et al (15) also observed that the ropiv- acaine group showed slightly higher verbal numerical rating scale scores at 8th and 10th hour postoperatively than levobupivacaine. Our study results differs from that of Mageswaran and Choy, (12) who observed no significant difference in VAS score and the time for rescue analgesia in both the groups.

CONCLUSION:

With the present study we can conclude that levobupivacaine 0.5% has early onset of sensory and motor blockade, prolonged duration of sensory and motor blockade, longer duration of postoperative analgesia when compared to ropivacaine 0.5 % at equal volumes. Dexamethasone added to local anaesthetic prolongs the duration of sensory block, motor block and duration of postoperative analgesia. All the drugs are devoid of any significant side effects at the concentration and volumes used for the study.

Any of the above drugs can be safely used for anaesthesia/analgesia, when administered carefully avoiding intravenous injection. However, we may consider

a) Levobupivacaine for its increased margin of safety i.e. it requires 30 times more blood level than bupivacaine to trigger cardiac and CNS side effects.
b) Ropivacaine though has a shorter duration of sensory and motor block but it may be a preferred option because of its decreased CNS and cardio toxic potential and when early return of motor activity is required postoperatively.

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