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Anesthesiology

KEY WORDS: supraclavicular brachial plexus block, ropivacaine 0.75%, bupivacaine 0.5%, upper limb surgeries.

A CLINICAL COMPARISON OF 0.75% ISOBARIC ROPIVACAINE WITH 0.5% ISOBARIC BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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ABSTRACT

Background: Regional anaesthesia and analgesia, has the potential to provide excellent operating conditions along with better and prolonged post-operative with pain relief with fewer side effects. As a result, it is becoming increasingly popular for ambulatory anaesthesia and for day care patients..Among the commonly used local anaesthetics, lignocaine and bupivacaine, bupivacaine has significant cardiovascular and central nervous system toxicity. In addition, bupivacaine also has lesser differentiation between sensory and motor blockade post-operatively. Ropivacaine and levobupivacaine were developed to avoid the bupivacaine related toxicities. The clinical safety profile of ropivacaine seems to be more favourable than that of levobupivacaine. With this background the following study was conducted to evaluate the efficacy of ropivacaine 0.75% for brachial plexus block in upper limb surgeries and its clinical comparison with bupivacaine 0.5%.

Aims And Objectives: To assess the efficacy and toxicity of ropivacaine 0.75% and bupivacaine 0.5% as potential agents for brachial plexus block for surgeries of the upper limb around and below the elbow.

Settings And Design: prospective, comparative, randomized, single blinded clinical trial.

Materials And Methods: After institutional ethical committee approval, 100 patients physical status ASA I & II, of either sex, between 18-60 years, weighing between 40-60 kgs posted for upper limb surgeries around the elbow, forearm and hand were divide into two groups of 50 patients each. Group R (Ropivacaine group) received 0.75% isobaric ropivacaine 30 ml in supraclavicular brachial plexus block. Group B (Bupivacaine group) received 0.5% isobaric bupivacaine 30 ml in supraclavicular brachial plexus block by using peripheral nerve stimulator. Vitals, sensory, motor and analgesia score at pre-defined intervals intra-operatively were noted. Onset of analgesia, sensory & motor blockade, total duration of post-operative pain relief (VAS ≥ 5) and time of demand of first rescue analgesic were also noted along with any intra-operative complications, if any.

Statistical Analysis: All the results were expressed as Mean ± SD. Statistical analysis was performed using Unpaired Student's t-Test. Statistical significance was considered with a p value of ≤ 0.05.

Results: Demographic profile and duration of surgery were comparable among the two groups. The mean time of onset of sensory block, onset of motor block and onset of analgesia were significant ($p<0.05$) in group R as compared to group B. The mean duration of sensory block and duration of post-operative analgesia were comparable between the two groups. However, the mean duration of motor block was significantly lower ($p<0.05$) in group R as compared to group B. the baseline hemodynamic variables and requirement of first analgesic dose and other adverse events were equivalent in both the group.

Conclusion: Ropivacaine when compared with Bupivacaine, has faster onset of analgesia, sensory & motor blockade, significantly lesser duration of motor blockade. Ropivacaine also provides satisfactory post-operative analgesia with a stable hemodynamic profile similar to Bupivacaine with no undue adverse effects.

INTRODUCTION

Regional anaesthesia and analgesia, has the potential to provide excellent operating conditions along with better and prolonged post-operative with pain relief with fewer side effects. As a result, it is becoming increasingly popular for ambulatory anaesthesia and for day care patients .In the recent years the regional techniques of brachial plexus block gained importance for surgical, diagnostic and therapeutic purposes in interventional pain management in injuries of the upper limb. It provides ideal conditions for surgery, maintains stable hemodynamics intra-operatively, decreases vasospa sm, edema and post-operative pain along with early ambulation, return to work and other advantages of regional technique which avoids general anaesthesia and its complications. Among the commonly used local anaesthetics, lignocaine and bupivacaine, bupivacaine has significant cardiovascular and central nervous system toxicity. In addition, bupivacaine also has lesser differentiation between sensory and motor blockade post-operatively. Ropivacaine and levobupivacaine were developed to avoid the bupivacaine related toxicities. The clinical safety profile of ropivacaine seems to be more favourable than that of levobupivacaine. With this background the following study was conducted to evaluate the efficacy of ropivacaine 0.75% for brachial plexus block in upper limb surgeries and its clinical comparison with bupivacaine 0.5%.

MATERIALS AND METHODS

After institutional ethical committee approval, 100 patients physical status ASA I & II, of either sex, between 18-60 years, weighing between 40-60 kgs posted for upper limb surgeries around the elbow, forearm and hand ,who gave consent for undergoing the procedure were included in the study. Patients were divided randomly into two groups of 50 patients each depending on the drugs used for brachial plexus block,

Group R-received Inj. Ropivacaine 0.75% isobaric 30ml,
Group B –received Inj. Bupivacaine 0.5% isobaric 30 ml.

All the patients were informed in detail regarding the nature and purpose of the study and also 0-10 point Visual Analogue Score(VAS) was explained on sheet of paper where 0 labeled as no pain and 10 labeled as excruciating pain and written informed consent was taken.

Baseline vitals, oxygen saturation were recorded, supracla vicular block was done using a peripheral nerve stimulator to locate the brachial plexus. Point of entry being 1-1.5 cm above the midclavicular line just lateral to the subclavian artery pulsation (Classical Approach). After successful placement confirmed by contraction of the muscles of forearm and hand at a current of 5mA, 30 ml of the drug was injected in intermittent doses of 5ml after careful negative aspirations.

Sensory blockade was assessed with pin prick to 23 G hypodermic needle and graded as 0 to 2 score with 0-sharp pain to pin prick and 2-no touch sensation. Motor blockade by Bromage three point score and analgesia assesment by Visual Analogue scale (VAS) was done.

Post procedure vitals, oxygen saturation along with sensory, motor and analgesia score were documented at pre-defined intervals intraoperatively. Onset of analgesia , sensory and motor blockade were noted. Total duration of post-operative pain relief (VAS≥5) and time of demand of first rescue analgesic (INJ. Diclofenac 75mg IM) and also the total requirement of rescue analgesic were also noted. Complications arising if any due to procedure or drug used were also noted.

All the results were expressed as Mean ± SD. Statistical analysis was performed using Unpaired Student's t-Test. Statistical significance was considered with a p value of ≤ 0.05

RESULTS AND ANALYSIS

The demographic profile of the participants of both the groups and also the duration of surgery in both the groups were comparable.

Demographic Profile	Group B Mean ±SD	Group R Mean ±SD
Age (in years)	34.88 ± 11.31	33.96 ± 10.61
Weight (in kgs)	54.98 ± 7.63	53.86 ± 8.35
Height (in cm)	157.00 ± 2.74	159.00 ± 3.31
ASA Physical Status	31/14	28/22
Gender (M:F)	26/24	27/23
Duration of surgery (in hrs)	1.48 ± 0.45	1.37 ± 0.37

Both the onset (7min) and the peak (18 min) of sensory blockade were faster in Group R when compared to Group B (9min and24 min) and were statistically significant (p≤0.05). However with respect to duration of sensory block there were no statistically significant (p≥0.05) between the two groups.

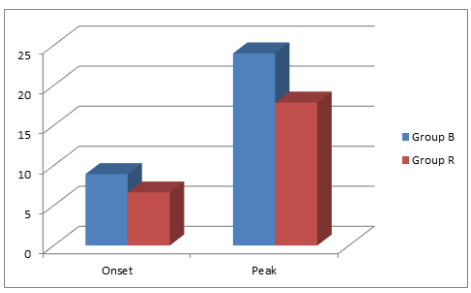

Fig: Characteristic Of Sensory Block (in Mins)

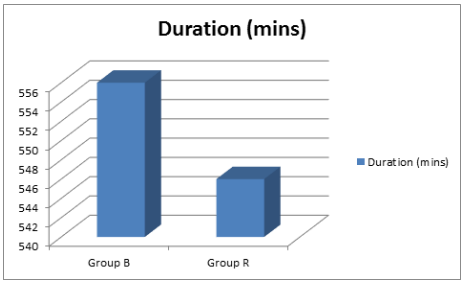

Fig: Duration Of Sensory Block

The onset and peak of motor blockade was faster in Group R (p≤0.05). The duration of motor block was shorter in Group R by approximately 2 hrs.

Motor	Group B	Group R	P value
Onset	11.78±2.85	10.82±2.21	<0.05
Peak	30.28±5.26	23.65±3.78	<0.05
Duration	496.5±52.16	379.8±60.15	<0.05

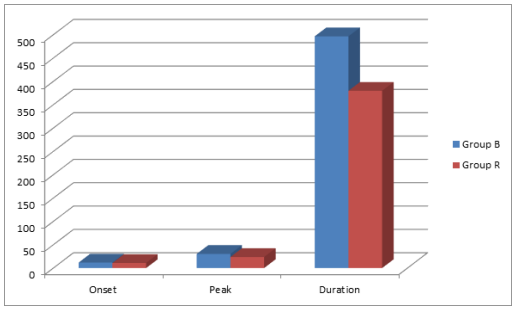

Fig: Motor Blockade (in Mins)

The onset and peak of analgesia were faster in Group R (p<0.05). There was no statistically significant difference in the duration of analgesia between the two groups.

Analgesia (mins)	Group B Mean± SD	Group R Mean± SD	P value
Onset	8.7 ±2.24	6.60±1.99	<0.0001
Peak	20.8±3.89	14.64±2.72	<0.0001
Duration	617.2±40.26	612.8±48.74	>0.05

There was no statistically significant difference noted in heart rate at various interval in the first 24 hrs in both the groups(p>0.05)

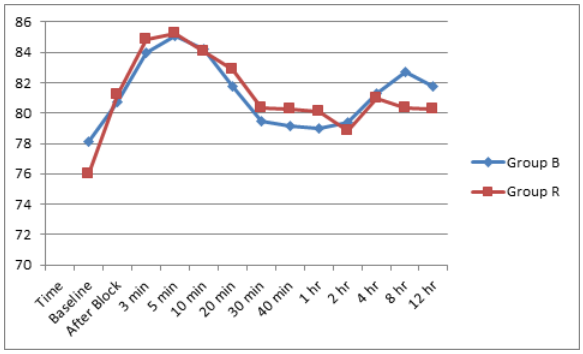

Fig: Heart Rate Variation At Time Intervals Between The Two Groups.

There was a significant fall in mean arterial blood pressure in Group R at 5hr,6hr, 8hr ,10 and 12 hr as compared to Group B, but it was not clinically significant as mean arterial pressure did not fall <20% from baseline.

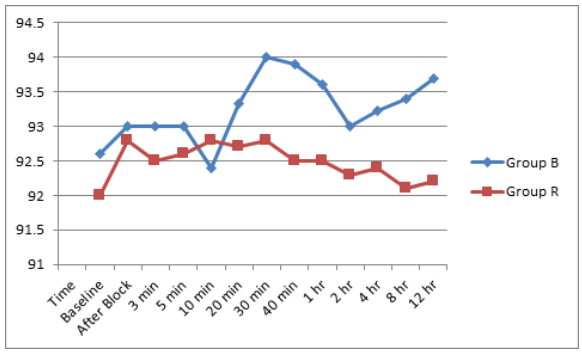

Fig: Map Variation With Time Between The Groups.

There was significant difference in the motor score between the two groups at hr 3 to hr 5 which was statistically significant.

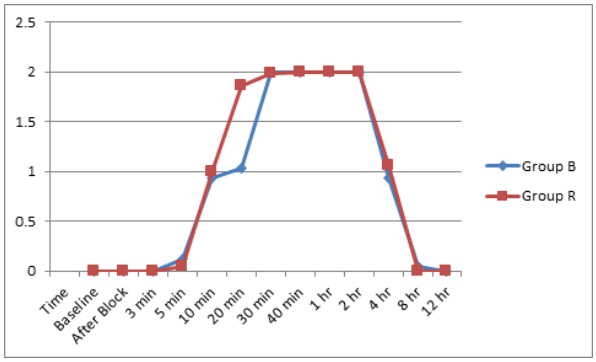

Fig: Change In Mean Motor Score.

The difference in changes in sensory score between the two groups was statistically significant from 3 mins to 30 mins and then again from 6 hr to 10 hr.

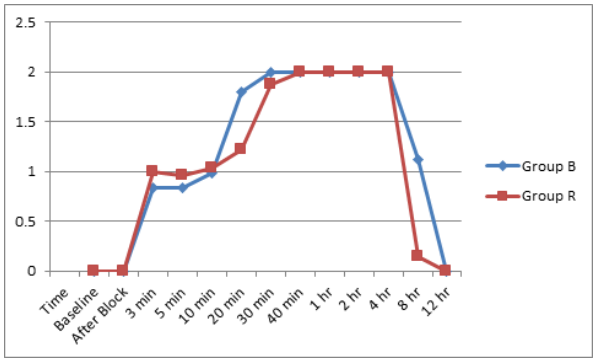

Fig: Changes In Mean Sensory Score.

The VAS score were comparable in both the groups and were of no statistical significance.

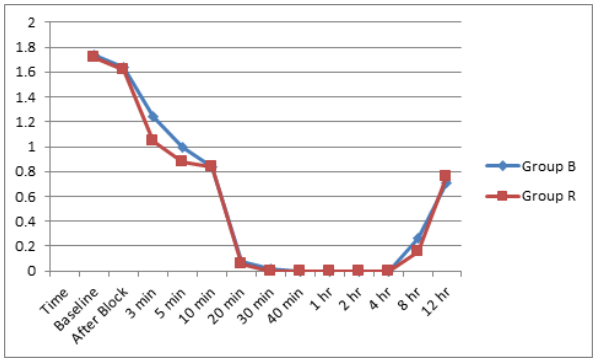

Fig: Changes In Mean Vas Score.

In Group B 62% of patients and in Group R 54% of patients required 3 doses of rescue analgesics in the first 12 hrs post operatively which was not statistically significant.

No complications or adverse events were observed in either of the groups.

DISCUSSION

100 patients physical status ASA I & II, of either sex, between 18-60 years, weighing between 40-60 kgs posted for upper limb surgeries around the elbow, forearm and hand were included in our study were given supraclavicular brachial plexus block and divided into two groups of 50 numbers each based on whether they received Inj. Ropivacaine 0.75% 30 ml isobaric or Inj. Bupivacaine 0.5% 30ml isobaric.

Both groups were given similar standardized anesthesia and were compared with similar parameters. The two groups were comparable in terms of demographic data.

In our study, 30ml of 0.5% bupivacaine and 30 ml 0f 0.75% ropivacaine were administered in supraclavicular brachial plexus block. In majority of the patients with this concentration of drugs, mean onset time of sensory block was 6.62±2.82 mins for Ropivacaine and 8.91±1.82 mins for bupivacaine; peak effects were achieved in 17.85±3.84 mins for Ropivacaine and 23.99±6.97 mins for bupivacaine respectively. However, the mean time of onset of motor blockade was 10.82±2.21 mins for ropivacaine and 11.78±2.85 mins for bupivacaine, peak motor effects were achieved in 23.65±3.78 mins and 30.28 mins respectively. The mean time of onset of analgesia were 6.60±1.99 mins for ropivacaine and 8.72±2.24 mins for bupivacaine , peak analgesia were achieved in 14.64±2.72 mins and 20.8±3.89 mins respectively.

These findings were same with the findings of Rosemary Hickey MD, Kenneth Candido MD et al in 1990 and also with the findings of OWEN MD and Dean LS.

Similar findings were found with interscalene brachial plexus block in shoulder surgeries in the study by Ahmet Eroglu, Halil Uzunlar, Muhittin Sener, Yavuk Akinturk, Nesrin Erciyes.

J C Raeder, S Drosdahl, O Klaastad, O Kvalsvik, B Isaksen et at in their study of auxillary brachial plexus block found that equal volumes of ropivacaine 0.75% produces a better quality of block than 0.5% bupivacaine.

Laura Bertini MD, Vincent Tagariello MD, Stefani Mancini MD, Alma Ciaschi MD, Carla Maria Posteraro MD, Pia Di Benedetto MD et al in their study for axillary brachial plexus block concluded that onset time of sensory and motor blockade and peak time was shorter with ropivacaine than with bupivacaine. The quality of the anesthesia was higher with ropivacaine and the mean duration of motor blockade was significantly shorter in ropivacaine group as compared to bupivacaine allowing early ambulation. This findings were similar to the findings in our study.

Studies comparing acute toxicity of ropivacaine to bupivacaine found that ropivacaine was atleast 25% less toxic than bupivacaine with regard to tolerated doses with the threshold for CNS toxicity for ropivacaine being twice that of bupivacaine (Scott DB, Lee A, Fagan D, Bowler GM). Knudsen K, Beckmen Suurkulla M, Blomberg S, Sjovall J, Edvardson established maximum tolerated dose for CNS symptoms was higher with ropivacaine as compared to bupivacaine. The threshold for CNS toxicity was apparent at a mean free plasma concentration of approximately 0.6mg/l for ropivacine and 0.3mg/l for bupivacaine.

In our study the hemodynamic profiles in either of the groups were stable and remained comparable to either groups. Bariskaner H, Tuncer S, Ulusoy H, Dogan H studied the effect of intravenous bupivacaine and ropivacaine on hemodynamic parameters in rabbits, concluded that neither of the drugs had any significant effect on respiratory rate, Spo2 and blood gas values.

The techniques like ultrasound guided nerve blocks and nerve locater assisted blocks offer the advantage of being more objective as the plexus /nerves can be identified more accurately, solutions used for neural blockade can be visually confirmed to be deposited in close proximity to the plexus and avoid possible injury to the nerve and surrounding structures. However ultrasonography needs availability, experience and experience and expertise in the field.

CONCLUSION

Ropivacine 0.75% is a better alternative to bupivacaine as

long acting local anesthetic in supraclavicular brachial plexus block. It provides profound surgical Anaesthesia of the upper limb with lesser duration of motor blockade along with stable hemodynamic profile and satisfactory postoperative pain free period without any adverse effect. The major advantages of ropivacaine over bupiovacaine are -(i) it provides more differential block, allowing for a better separation between sensory and motor blockade besides a shorter duration of motor blockade in the postoperative period. This makes it excellent for use in day care surgeries and (ii) a lower systemic than both bupivacaine and levobupivcaine.

Ultrasound guided nerve blocks which offer the advantage of being more objective as the plexus /nerves can be identified more accurately, solutions used for neural blockade can be visually confirmed to be deposited in close proximity to the plexus and avoid possible injury to the nerve and surrounding structures, should be used when experience and expertise in the field of ultrasound along with equipment is available.

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