A COMPARATIVE STUDY BETWEEN 0.75% ROPIVACAINE PLAIN AND 0.75% ROPIVACAINE WITH OPIOID ADDITIVE BUPRENORPHINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES

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ABSTRACT

BACKGROUND

Supraclavicular brachial plexus block provides safe, effective, low cost anaesthesia with excellent postoperative analgesia. The current study was an attempt to compare ropivacaine 0.75% with ropivacaine 0.75% plus buprenorphine 3 mcg/kg in supraclavicular brachial plexus block with respect to onset time and duration of sensory and motor blockade, duration of analgesia and side effects.

MATERIALS AND METHODS

Present study was carried out in the Department of Anaesthesiology, MVJ Medical College and RH, Hoskote, Bangalore, from September 2014 to July 2016. Each patient was randomly allocated to one of the two groups of 30 patients each. Group R (0.75% plain ropivacaine) will receive 3 mg/kg of plain ropivacaine as a 0.75% solution to a total volume of 30 mL by diluting with normal saline. Group B (0.75% ropivacaine with opioid additive buprenorphine) will receive 3 micrograms/kg of buprenorphine with 3 mg/kg of ropivacaine as a 0.75% solution to a volume of 30 mL by diluting with normal saline.
Parameters- The effect was studied with respect to onset time and duration of sensory and motor blockade, duration of analgesia and side effects.

RESULTS

Onset of sensory block in our study, we found that there was no significant changes in the onset of sensory blockade in group R (5.2 ± 0.3 mins.) compared to group B (5.1 ± 0.2 mins.) with a 'p' value of 0.134. Onset of motor block in our study, we found that there was no significant changes in the onset of motor blockade in group R (11 ± 2.10 mins.) compared to group B (10.8 ± 1.9 mins.) with a 'p' value of 0.70. Duration of sensory block in our study, we found that there was significant increase in the duration of sensory blockade in group B (11.8 ± 1.56 hrs.) compared to group R (9.7 ± 1.4) with a 'p' value <0.001. Duration of motor block in our study, we found that there was a significant increase in the duration of motor blockade in group B (11.12 =/- 1.64 hrs.) compared to group R (8.3 =/- 1.76 hrs.) with a 'p' value <0.001. Duration of analgesia in our study, we found that the time for demand of analgesics was significantly prolonged in group B, i.e. 17.45 ± 3.8 hrs. compared to group R, i.e. 10.7 ± 1.94. This difference was statistically significant with a 'p' value <0.001.

CONCLUSION

The addition of buprenorphine to ropivacaine solution for a brachial plexus block can modify the action of the local anaesthetic solution by its action. The dosage of 3 mcg/kg body weight used in our study significantly increased the duration of analgesia. There were no clinically significant side effects noted.

KEYWORDS

Comparative, Ropivacaine Plain, Ropivacaine with Buprenorphine, Supraclavicular Block.

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BACKGROUND

Peripheral nerve blockade is now a well-accepted concept for comprehensive anaesthetic care. Brachial plexus block is the commonest method used for upper limb surgeries. Supraclavicular brachial plexus block is the preferred regional anaesthesia for upper limb surgeries. Here, the brachial plexus is presented most compactly at the proximal division or at the trunk level that provides most reliable anaesthesia for upper limb surgeries by anaesthetising the middle and lower plexus. With the

introduction of newer and safer local anaesthetics, regional anaesthesia has been taken over as a principal technique for upper limb surgeries. One such newer and safer agent is ropivacaine.[1] Ropivacaine is a long-acting amide local anaesthestic structurally similar to bupivacaine, but less cardiotoxic than bupivacaine. Certain drugs may be used as adjuncts to local anaesthetics to lower the dose of each agent to enhance onset, duration of action and analgesic efficacy. Some of the additives such as opioids and alpha-2 agonists have been tried to prolong the duration of peripheral nerve block. One such an opioid adjuvant is buprenorphine.[2] Buprenorphine is an opioid additive. It is a semisynthetic the baine congener and it is 30-32 times more potent than morphine. It has high affinity for MU receptors, hence provides longer duration of action.[3]

Aims and Objectives

The present study was a prospective study at MVJ Medical College and Research Hospital, Hoskote, Bangalore, in the Department of Anaesthesiology with the objective to compare the effect of ropivacaine 0.75% plain (3 mg/kg body weight) and 0.75% ropivacaine (3 mg/kg body weight) with opioid additive buprenorphine (3 mcg/kg body weight) used for supraclavicular approach to brachial plexus block for upper limb surgeries with respect to-

- Onset time of sensory blockade.
- Onset time of motor blockade.
- Duration of sensory blockade.
- Duration of motor blockade.
- Duration of analgesia.
- Side effects if any.

MATERIALS AND METHODS

Source of Data

Study Design- Randomised clinical trial; Sample Size- 30 subjects in each group; Sampling Method- Simple random sampling; Statistical Analysis- Repeated measures of ANOVA for vital events and Student's t-test.

Sixty patients aged between 18 years and 60 years of physical status ASA grade 1 and ASA grade 2 undergoing elective upper limb surgeries lasting more than 30 minutes was included in the study.

Exclusion Criteria

1. Other than ASA1 and ASA2.
2. Known allergy to local anaesthetic agents and opioids.
3. Local infection at the site of block.
4. Pregnant women.

An intradermal wheal raised about 1 cm above the midclavicular point. Subclavian artery palpable in supraclavicular fossa used as landmark. A 23-gauge needle inserted behind the artery in backward-inward-downward direction till paraesthesia in the forearm elicited. After negative aspiration for blood, 30 mL of respective drug was injected depending on whether patient is allotted to either group R and B.

Sensory block was assessed by pinprick with 23G hypodermic needle in skin dermatomes, C5-T1 once in every 2 minutes for initial 30 minutes and thereafter every 30 minutes till patient regains normal sensations and graded according to-

1- Normal response to pinprick.
2- Dull response to pinprick (onset).
3- No response to pinprick (peak).

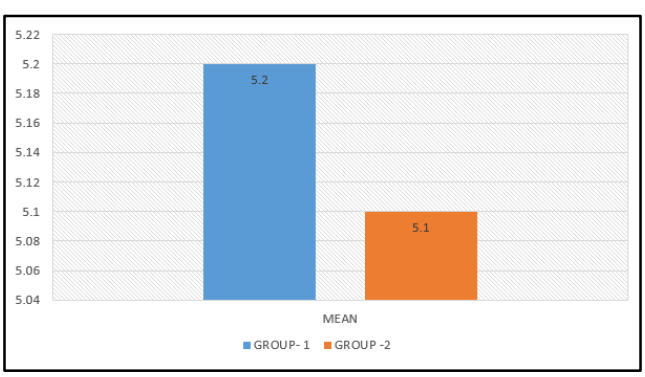
Quality of motor block was assessed at the same intervals and graded according to modified to Lovett's scoring as duration of analgesia assessed by Visual Analogue Scale (VAS). Rescue analgesia given when VAS score was equal to or more than 5 with Inj. Diclofenac 75 mg IV.

RESULTS

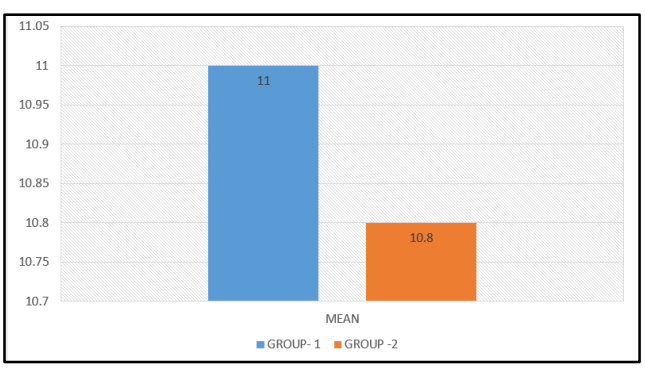
The sensory onset time in group (R) was 5.2 ± 0.3 mins. and in group B was 5.1 ± 0.2 mins. with 'p' value of 0.134 and motor onset in group R to be 11 ± 2.10 mins. and group B 10.8 ± 1.9. The duration of sensory blockade in our study was 9.7 ± 1.94 hrs. in group R and 11.8 ± 1.56 hrs. In group B, the mean time from onset of block to request of analgesia is taken as total duration of analgesia. It was 10.7 ± 1.94 hrs. in group R and 17.45 ± 3.8 hrs. in group B. We documented several important haemodynamic parameters periodically for all the patients in both the study groups. We observed that the changes in both the groups were comparable and there were no significant adverse change in any of the vital parameters in group R compared to group B.

Group 1 = 0.75% ropivacaine plain.

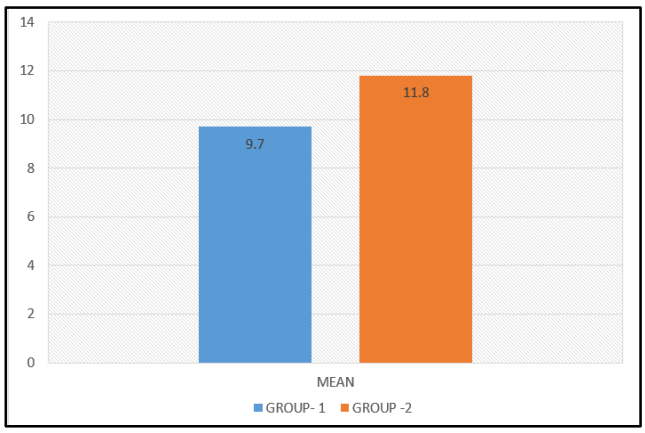
Group 2 = 0.75% ropivacaine with buprenorphine.



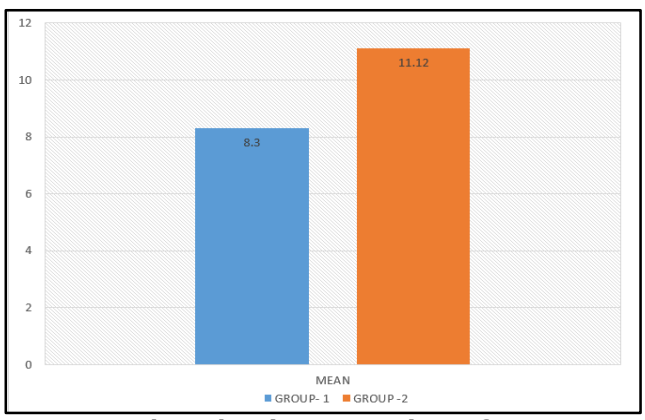
Graph 1. Showing Comparison of Mean Onset of Sensory Blockade between Groups



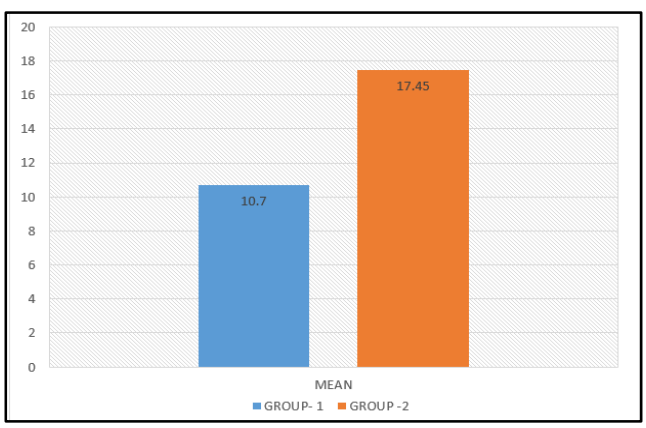
Graph 2. Showing Comparison of Mean Onset of Motor Blockade between Groups



Graph 3. Showing Comparison of Duration of Sensory Blockade between Groups



Graph 4. Showing Comparison of Mean Duration of Motor Blockade between Groups



Graph 5. Showing Comparison of Mean Duration of Analgesia between Groups

In Minutes	Group 1	Group 2	P Value
Mean ± SD	5.2 ± 0.3	5.1± 0.2	0.134

Table 1. Comparison of Mean Onset of Sensory Blockade between Groups

In Minutes	Group 1	Group 2	P Value
Mean ± SD	11 ± 2.10	10.8 ± 1.9	0.70

Table 2. Comparison of Mean Onset of Motor Blockade between Groups

In Hours	Group 1	Group 2	P Value
Mean ± SD	9.7 ± 1.94	11.8 ± 1.56	<0.001

Table 3. Comparison of Duration of Sensory Blockade between Groups

	Group 1	Group 2	P Value
Mean ± SD	8.3 ± 1.76	11.12 ± 1.64	<0.001

Table 4. Comparison of Mean Duration of Motor Blockade between Groups

	Group 1	Group 2	P Value
Mean ± SD	10.7 ± 1.94	17.45 ± 3.8	<0.001

Table 5. Comparison of Mean Duration of Analgesia between Groups

MAP (mmHg)	Group 1	Group 2	P Value
0 min.	95.03 ± 5.90	95.20 ± 5.84	0.913
5 mins.	94.47 ± 7.21	95.18 ± 5.25	0.664
10 mins.	94.14 ± 5.40	94.49 ± 4.21	0.784
15 mins.	92.91 ± 5.67	92.40 ± 4.19	0.693
20 mins.	91.49 ± 4.77	90.96 ± 4.09	0.643
25 mins.	92.18 ± 4.95	90.29 ± 3.51	0.094
30 mins.	89.77 ± 4.91	89.07 ± 3.87	0.542

Table 6. Comparison of Map (mmHg) in Two Groups Studied

Pulse Rate	Group 1	Group 2	P Value
0 min.	79.63 ± 7.84	79.63 ± 8.25	1.000
5 mins.	79.17 ± 7.69	79.47 ± 7.72	0.881
10 mins.	76.57 ± 14.82	76.27 ± 14.75	0.938
15 mins.	78.20 ± 6.87	78.23 ± 6.44	0.985
20 mins.	77.37 ± 6.42	76.93 ± 6.06	0.789
25 mins.	77.80 ± 6.14	76.70 ± 5.70	0.475
30 mins.	76.13 ± 5.40	75.27 ± 4.3	0.494

Table 7. Comparison of Pulse Rate (BPM) in Two Groups Studied

DISCUSSION

A variety of receptors mediate antinociception on peripheral sensory axons. The peripheral administration of appropriate drugs (adjuncts) may have analgesic benefit and reduce systemic adverse effects. In an attempt to improve perioperative analgesia, a variety of adjuncts such as opioids, verapamil, neostigmine and tramadol have been administered concomitantly with local anaesthetics into the brachial plexus sheath.[4] The aim of this study is to evaluate whether additional anaesthetic and analgesic effects could be derived from administration of opioid additive, buprenorphine into brachial plexus sheath.

The study was a randomised, comparative study carried out at MVJ Medical College and Research Hospital, Hoskote, Bangalore. Sixty ASA I and II patients undergoing elective upper limb surgery were included in the study. Each patient was randomly allocated to one of the two groups of 30 patients each group R received 3 mg/kg body weight of ropivacaine 0.75% made to a total volume of 30 mL by diluting the drug with normal saline group B received 3 mg/kg body weight of ropivacaine 0.75% and buprenorphine 3 mcg/kg made to a total volume of 30 mL by diluting with normal saline. Parameters observed include onset of sensory blockade, onset of motor block, duration of sensory blockade, duration of motor blockade and duration of analgesia.

It was observed in our study that the demographics, which included age distribution, gender distribution, height

and weight of the patients were comparable in both the groups and there was no significant disparities in the groups under study.

Onset of Sensory and Motor Block- In our study, we observe that the sensory onset time in group (R) was 5.2 ± 0.3 mins. and in group B was 5.1 ± 0.2 mins. with a 'p' value of 0.134 and motor onset in group R to be 11 ± 2.10 mins. and group B 10.8 ± 1.9, which is statistically insignificant.

This observation well matches with study of Abbey Matthew et al 2014, which showed no statistical difference was found in the mean onset time of sensory and motor blockade.

Similar observation was made by Surekha Patil et al in 2015[5] where there was no difference between two groups on mean onset of sensory and motor block.

In a study conducted by Kenneth Candido et al, they found that there was no significance in sensory and motor onset times with the use of perineural buprenorphine as an additive to local anaesthetics.

Duration of Sensory and Motor Blockade- The duration of sensory blockade in our study was 9.7 ± 1.94 hrs. in group R and 11.8 ± 1.56 hrs. in group B, which is statistically significant with 'P' value, P=<0.001.

These observations are matched with the study conducted by Surekha et al where they observed that the mean duration motor block was significantly longer in group B (4.93 ± 0.94 hrs.) than in group C (2.25 ± 0.62 hrs.) (P<0.05). The mean duration of sensory block was also significantly longer in group B (5.71 ± 0.94 hrs.) than in group C (4.94 ± 0.70 hrs.) with P <0.05. They concluded that addition of 3 mg/kg buprenorphine to 0.5% bupivacaine for supraclavicular brachial plexus block, prolonged duration of postoperative analgesia and sensory blockade without an increase in side effects.

In 2012, Behr A, Freo U, Ori C et al[6] found similar results in their study. They have observed that the duration of both sensory block and postoperative analgesia was longer (P <0.05) in patients who had received epineural buprenorphine (856.1 ± 215.2 and 1,049.7 ± 242.2 mins.) than in patients who had received intramuscular buprenorphine (693.6 ± 143.4 and 820.3 ± 335.3 mins.) or saline (488.3 ± 137.6 and 637.5 ± 72.1 mins.).

Kinjal S Sanghvi et al[7] have come to similar conclusions through their study with bupivacaine and buprenorphine in axillary brachial plexus block. Mean duration of motor block was 284.33 ± 78.94 mins. in group I and in group II 307.33 ± 60.26 mins. Mean duration of sensory block 305.066 ± 83.64 mins. in group I, while 580.166 ± 111.45 mins. in group II, it suggests duration of sensory and motor block was prolonged in group II than group I.

Duration of Analgesia- The mean time from onset of block to request of analgesia is taken as total duration of analgesia. It was 10.7 ± 1.94 hrs. in group R and 17.45 ± 3.8 hrs. in group B, which is statistically significant with a 'p' value of <0.001.

In 1989 by Viel et al compared the effectiveness of morphine in a dose of 50 mcg/kg body weight with buprenorphine 3 mcg/kg body weight added to local anaesthetic in supraclavicular brachial plexus block. The analgesic effect of the blockade was two times longer in the buprenorphine group.[8]

Similarly, in 2001, Candido et al showed the prolongation of analgesic effect with mepivacaine and tetracaine from 5.3 to 17.4 hrs. after adding buprenorphine to the infraclavicular brachial plexus block.

D Tripathi, K Shah, S Shah and E Shah et al in their study have found concurring results that in comparison to equal volume of 0.5% bupivacaine, 0.75% ropivacaine provides earlier onset and peak of sensory blockade (p<0.05) with comparable duration of postoperative analgesia (P>0.05).[9]

Haemodynamics remained stable and no complications were encountered in both the groups. The study concluded that 30 mL of 0.75% ropivacaine has effective anaesthetic and safety profile in supraclavicular brachial plexus block with excellent postoperative analgesia.

Anmol Singh et al studied the effect of buprenorphine as a perineural adjuvant and found matching results. It was observed that postoperative analgesia was significantly longer (901.33 ± 60.04 mins.) in group B as compared to group C (343.00 ± 33.02 mins.) with 'p' value <0.001. Duration of sensory block in group C was 322.16 ± 31.80 mins. and in group B 647.83 ± 55.70 mins. with 'p' value <0.001. Pain score was significantly low in group B (mean 1.44) compared to group C (mean 5.60) at 12 hours, postoperatively.

Abbey Matthew et al in their study have similar findings showing that the duration of analgesia was significantly longer in group B (13.24 hrs.) compared to group A (6.68 hrs.) with a 'p' value <0.001.

Kenneth D. Candido, M.D.; Carlo D. Franco, M.D.; Mohammad A. Khan, M.D.; Alon P. Winnie, M.D.; Durre S. Raja, M.D. from the Department of Anesthesiology and Pain Management, Cook County Hospital, Chicago, IL, conducted a study to determine the contribution of the buprenorphine to postoperative analgesia when added to a shorter-acting local anaesthetic.

The mean duration of postoperative pain relief following the injection of the local anaesthetic alone was 5.3 (± 0.15) hours as compared with 17.4 (± 1.26) hours when buprenorphine was added, a difference that was statistically (and clinically) significant (P <0.0001).

Haemodynamic Changes (Table 6 and 7)

In our study, we documented several important haemodynamic parameters periodically for all the patients in both the study groups. We observed that the changes in both the groups were comparable and there were no significant adverse change in any of the vital parameters in group R compared to group B. The mean pulse rate for group R was 79.63 ± 7.84, 78.20 ± 6.87, 76.13 ± 5.40 at

0 mins, 15 mins. and 30 mins. into the surgery, respectively. The pulse rate for group B was 79.63 ± 8.25, 78.23 ± 6.44, 75.27 ± 4.3 at 0, 15 and 30 mins. into the surgery, respectively.

The Mean Arterial Pressure (MAP) for group R was 95.03 ± 5.90, 92.91 ± 5.67, 89.77 ± 4.91 at 0, 15 and 30 mins. into the surgery, respectively. The MAP for group B was 95.20 ± 5.4, 92.40 ± 4.19, 89.07 ± 3.87 at 0, 15 and 30 mins. into the surgery, respectively.

Side Effects- The main side effects under study was hypotension, bradycardia, nausea and vomiting. During the course of our study, we did not document any side effects during the surgery period or postoperatively in any of the patients in group R or group B due to the drugs at the dose administered.

Kalyani Nilesh Patil et al[10] in their study on ropivacaine with adjuncts in supraclavicular peripheral blocks also have concluded that the drug is well tolerated by the patients and there were no adverse effects.

CONCLUSION

There was no significant changes in the onset of sensory blockade in group R (5.2 ± 0.3 mins.) compared to group B (5.1 ± 0.2 mins.) with a 'p' value of 0.134. There was no significant changes in the onset of motor blockade in group R (11 ± 2.10 mins.) compared to group B (10.8 ± 1.9 mins.) with a 'p' value of 0.70. There was significant increase in the duration of sensory blockade in group B (11.8 ± 1.56 hrs.) compared to group R (9.7 ± 1.4) with a 'p' value <0.001. There was a significant increase in the duration of motor blockade in group B (11.12 =/- 1.64 hrs.) compared to group R (8.3 =/- 1.76 hrs.) with a 'p' value <0.001. Also, the time for demand of analgesics was significantly prolonged in group B, i.e. 17.45 ± 3.8 hrs. compared to group R, i.e. 10.7 ± 1.94. This difference was statistically significant with a 'p' value <0.001. In conclusion, the addition of buprenorphine to ropivacaine solution in brachial plexus block can modify the action of the local anaesthetic solution. The dosage of 5 mcg/kg body weight used in our study significantly increased the duration of analgesia. There were no clinically significant side effects noted. Hence, buprenorphine forms an unique opioid adjuvant for local anaesthetics when used for brachial plexus block.

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