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Original Research Article

Clinical Comparative Evaluation of Bupivacaine with Fentanyl and Ropivacaine with Fentanyl in Upper Limb Surgery Under Supraclavicular Brachial Plexus Block

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Conflict of interest: Nil

Abstract:

Introduction: A supraclavicular block is often recommended for surgeries conducted on the upper limb not involving the shoulder. The supraclavicular block is a safe regional anaesthesia technique associated with rapid onset and reliable anaesthesia.

Aim: The present study was conducted to compare the clinical effectiveness of supraclavicular block using ropivacaine (0.5%) and bupivacaine (0.5%) given along with Fentanyl.

Materials and Methods: This was a clinical comparative, cross-sectional study involving a total of 60 patients (30 patients in each group) aged 18 to 60 years belonging to American Society of Anaesthesiologists (ASA) status 1 or 2, admitted to JK Hospital, Bhopal. Group B received 0.5% bupivacaine and group R 0.5% ropivacaine into the supraclavicular region, by a nerve-stimulator technique along with Fentanyl. We collected data on the onset and total duration of sensory and motor block for both bupivacaine and ropivacaine.

Results: The mean time for the onset of complete sensory block observed with bupivacaine and ropivacaine was 558 seconds and 402 seconds, ($p = 0.004$) respectively. The mean time for the onset of complete motor block observed with bupivacaine and ropivacaine was 986 seconds and 813 seconds, ($p = 0.002$) respectively. The mean total duration of the sensory block with bupivacaine and ropivacaine was 442 and 388 minutes, respectively ($p<0.001$). The mean duration of the motor block with bupivacaine and ropivacaine was 414 and 353 minutes, respectively ($p<0.001$). The preoperative, intraoperative and postoperative heart rate, systolic & diastolic blood pressure and oxygen saturation were comparable among the two study groups ($p>0.05$). There were zero incidents of side effects or adverse events in either of the two local anaesthesia groups.

Conclusion: The onset of sensory and motor block was significantly different among the participants given bupivacaine and ropivacaine. The total duration of sensory and motor block was significantly different among the participants given bupivacaine and ropivacaine.

Keywords: Supraclavicular brachial plexus block, Bupivacaine, Ropivacaine.

Introduction

Peripheral nerve blocks have become important in clinical practice because of their role in post-operative pain relief, reduction in the need for postoperative analgesics, lowers incidence of nausea and vomiting and increases the patient satisfaction [1].

Peripheral nerve blocks can be customized and used for anaesthesia, postoperative analgesia and diagnosis and treatment of chronic pain disorders. The regional technique chosen depends upon the surgical site, the anticipated length of the procedure, ambulation requirements, and the desired duration of postoperative pain control. Supraclavicular brachial plexus blocks are among the most commonly performed peripheral neural blocks for upper extremity surgeries in clinical practice [2].

Bupivacaine 0.5% has been most frequently used as a local anaesthetic agent for brachial plexus block for many years because of its favourable ratio of sensory to motor neural block and longer duration of action. However, bupivacaine has disadvantage of cardiac and central nervous system toxic effects in some patients attributed to its high plasma concentration after accidental intravascular administration[3]. Ropivacaine has been shown to produce less cardiotoxic, and central nervous system toxic effects, less motor blockade and

similar duration of sensory analgesia when compared to bupivacaine [4,5]. A number of opioids have been used as adjuvants with local anaesthetics for brachial plexus blocks with possibility of increasing duration of action, improving quality of analgesia and to reduce dose of local anaesthetic agents.

Opioids like morphine, tramadol and fentanyl have been added to enhance block characteristics of local anaesthetic agent [6]. In view of the safety profile of ropivacaine compared to bupivacaine, the present study is was undertaken to compare effects in terms of onset and duration of sensory and motor block and duration of analgesia.

Methodology

This study is a single centre, hospital (inpatient) based, cross-sectional, observational study and was conducted at the Department of Anaesthesiology, L N Medical College & Research Centre and affiliated J K Hospital, Bhopal. A total of 60 major and minor surgeries were taken over a period of twelve months.

Inclusion criteria was, patients scheduled for upper limb surgery under supraclavicular brachial plexus block, adult patients aged between 18-60 years, patients of all genders, patients categorised belonging to ASA physical status I and II, patients who gave written informed consent to participate in the study. While exclusion criteria were patients categorised belonging to ASA physical status III or higher, history of allergy to study drugs, patients with a history of alcohol or drug abuse or any neurological disorders, patients who needed supplementation with general anaesthesia, patchy or inadequate analgesia or block failure, patients with coagulation abnormalities and sepsis, patients with compromised cardio-pulmonary profile, patients with multiple trauma and acute spinal cord injuries, severe liver or renal diseases, local skin infection, contraindication to nerve block, patien's refusal to take part in the study.

All study participants were visited one day before the surgery and a detailed pre-anaesthetic evaluation was completed. Appropriate laboratory and radiological investigations were conducted. Those patients scheduled for upper limb surgery were approached by the principal investigators and scrutinized using the inclusion and exclusion criteria.

Thereafter, the shortlisted participants were asked to informed consent. On arrival in the operating room, the identity of the participant and the consent were verified again; the preoperative assessment was reviewed and updated. Various monitors were attached to measure the multiple vital parameters. Baseline haemodynamic parameters were recorded 15 minutes before giving nerve block.

The participants were divided into Group BF & Group RF. Participants in the BF group were given Bupivacaine with Fentanylfor supraclavicular brachial plexus block [Bupivacaine (25 ml of 0.5%) + intravenously inj. Fentanyl 1 mcg/kg diluted in NS to make total volume 27ml]. Participants in the RF group were given Ropivacaine with Fentanyl for supraclavicular brachial plexus block [Ropivacaine (25 ml of 0.5%) + intravenously inj. Fentanyl 1 mcg/kg diluted in NS to make total volume 27ml]. Brachial plexus block was given by eliciting paraesthesia using the supraclavicular approach, patients were placed in a supine position with the head extended and rotated to the contralateral side; the arm to be anaesthetized was pronated and directed to the ipsilateral knee. Under aseptic precautions, the area was prepared and draped. A 22-gauge needle is inserted 1 cm above the clavicle and advanced at an angle perpendicular to the skin in medial, caudal, and slightly dorsal directions. The needle was advanced slowly until stimulation of the brachial plexus leading to paresthesia of the arm, and forearm occurred. Then the needle was stabilized, aspiration was attempted to exclude intravascular needle placement and the study drug was injected slowly with the repeated aspiration of every 2ml to rule out the accidental intravascular injection. Our Primary Outcome Parameter were Sensory Block following administration of Local Anaesthetics (Onset and Duration), Motor Block following administration of Local Anaesthetics (Onset and Duration), Changes in hemodynamic parameters following administration of Local Anaesthetics. While our Secondary outcome were prevalence of the any side effects (like hypotension, pruritis, bradycardia, nausea, vomiting, dizziness, anxiety, agitation, perioral numbness and arrhythmias. Sensory blocks were assessed using pin-prick test (response to atraumatic prick with the blunt 27 G needle) and patients were asked about the sensation. This procedure was repeated every 2 minutes until the onset of the block. We also assessed onset, duration & intensity of sensory block. And motor block (Onset, duration & intensity) were assessed using the „Modified' Bromage scale every 2 minutes from the injection of the drug. Haemodynamic parameters (heart rate, blood pressure, pulse oximeter, respiratory rate & temperature) were measured at an interval of 5 minutes starting from fifteen minutes before giving nerve block. Data collection included demographic details and pre-anaesthetic check-up, Pre, intra& post-operative details.

Result

Statistical analysis were done using a student‟s t-test/ wilcoxon‟s test. Categorical variables were analysed using chi-square test. A P-value <0.05 was considered statistically significant.Mean age of

group I & II patients were 36.66±11.59Year & 34.30±9.04 Year respectively. Mean weight of group I & II patients were 51.60±6.85 kg & 51.10±6.18 kg respectively. There was no statistically significant difference found in distribution of study subjects. (p>0.05)

At baseline, mean heart rates were 89.2±7.5 & 89.5±11.2 in group I & II respectively. At baseline mean SBP was 128.6±8.4 & 123.7 ± 24.9 in group I & II respectively. There was no statistically significant difference found in all vital sign between group I and group II at baseline. During follow up at 150 min heart rate significantly reduced to 76.4±5.1 & 77.5±4.7 in group I & II respectively. There was statistically no significant difference in mean heart rate between group I and group II at different time intervals(P>0.05). While in between both the groups mean heart rate significantly changed from baseline to 150 min. (p=0.001). There was statistically no significant difference in mean systolic blood pressure (SBP) between group I and group II at different time intervals among study subjects(P>0.05). While in both the groups mean systolic blood pressure (SBP) significantly changed from baseline to 150 min. (p=0.001)

At baseline mean diastolic blood pressures (SBP) were 80.2±5.5 &81.4±7.8 in groups I & II respectively. There was statistically no significant difference in mean diastolic blood pressure (SBP) between group I and group II at different time intervals (P>0.05). There was statistically no significant difference in mean respiratory rate (RR) between group I and group II at different time interval (P>0.05). At baseline (Pre op) mean SpO2 was 92.3±2.8 &98.7±0.7 in group I & II respectively. Mean VAS Score was 0.033±0.182 in group II patients at 120 minute and 0.233±0.430 at 150 minute respectively. Mean time of onset of sensory block was more in group I patients as compared to group II patients. It was 8.767±1.65 minute in group I & 6.800±1.15 in group II patients respectively. There was statistically highly significant difference found in mean time of onset of sensory block between group I and group II (P=0.001). Mean duration of sensory block was more in group I patients as compared to group II patients. It was 684.300±31.92 minute in group I & 568.167±77.03 in group II patients respectively. There was statistically highly significant difference found in mean duration of sensory block between group I and group II (P=0.001).

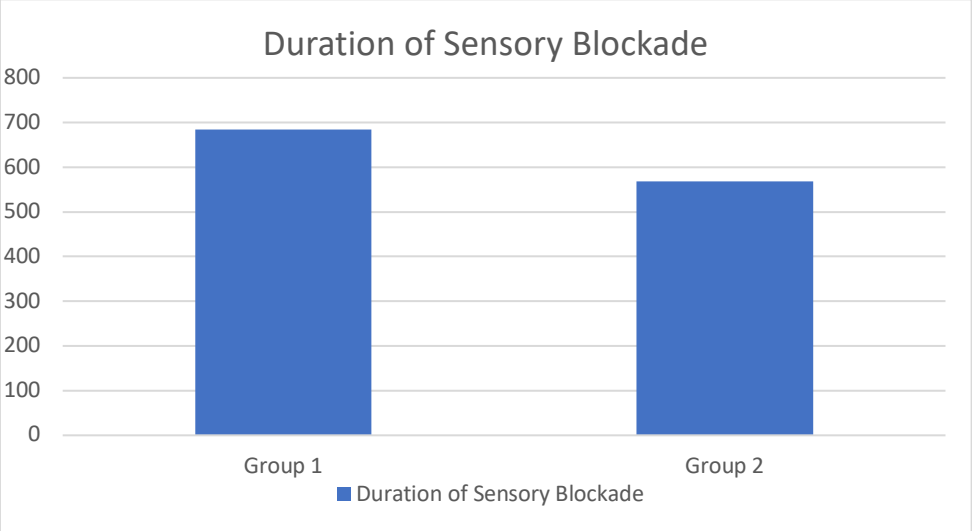

Figure 1: Duration of sensory blockade

Mean time of onset of motor block was more in group I patients as compared to group II patients. It was 14.467±1.92 minute in group I & 11.067±1.43 in group II patients respectively. There was statistically highly significant difference found in mean Time of onset of motor block between group I and group II(P=0.001). Mean duration of motor block was more among group I patients as compared to group II patients. It was 495.833±92.76 minute in group I & 402.833±93.21 in group II patients respectively. There was statistically highly significant difference found in mean duration of motor block between group I and group II (P=0.001).

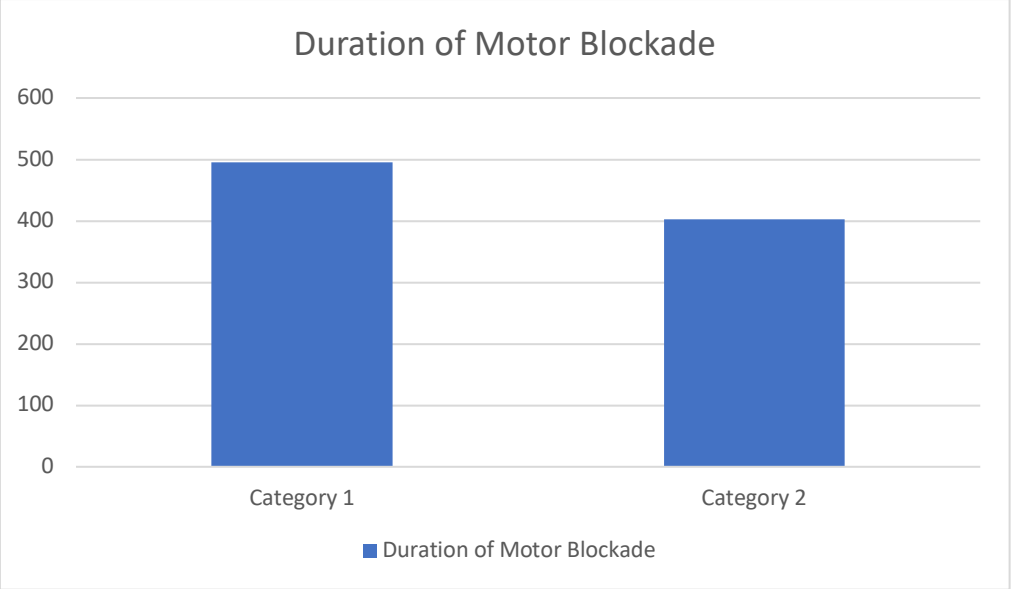

Figure 2: Duration of motor blockade

Mean duration of surgery was slightly more in group I patients as compared to group II patients. Mean time of rescue of analgesia was significantly more in group I patients as compared to group II patients. Among 30 patients in group I, 1 patient had nausea and 1 had hypotension while among 30 patients in group II, 1 patient had nausea and 1 had vomiting. There was statistically no significant difference in adverse effects in group I and group II patients at different time intervals (p=0.572).

Discussion

In recent era, adequate postoperative pain management is very important to facilitate rehabilitation and to accelerate functional recovery after upper limb surgery to enable patients to resume normal activity as soon as possible. It serves to blunt the autonomic, somatic, and endocrine reflexes with a resultant potential decrease in postoperative morbidity. Ropivacaine is a newer long-acting pure S-enantiomer is considered to be less cardiotoxic with a better safety profile when used in brachial block than bupivacaine with similar pharmacodynamics properties. It is less likely to penetrate large, myelinated motor nerve fibers, resulting in a relatively reduced motor blockade.

In our study demographic variables are comparable in each group in the form of age, weight, ASA grade, sex ratio and duration of surgery (p>0.05).All the patients in three groups were haemodynamically comparable in terms of Pulse, Systolic BP, Diastolic BP, respiratory rate and SpO2preoperatively (p>0.05).

Mean time of onset of sensory block was more among group I patients as compared to group II patients. It was 8.767±1.65 minute in group I & 6.800±1.15 in group II patients respectively. There was statistically highly significant difference found in mean time of onset of sensory block between group I and group II(P=0.001).

Shaliendra Modak et al[7] (2016) used 30 ml of 0.5% ropivacaine and bupivacaine 0.5% and concluded that ropivacaine had earlier onset of sensory block as compared to bupivacaine. It was 4.93±1.78 in ropivacaine group and 8.47±2.50 in bupivacaine group, which is in accordance with our study.

Anupreet Kaur et al[8] (2012-2013) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% ropivacaine in forearm surgeries. They concluded that onset of action of sensory block was early in ropivacaine group as compared to bupivacaine group, which is highly significant statistically and similar to our study.

Ranjan R. Venkatesh et al[9] (2010-2012) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% and 0.75% ropivacaine. They concluded that onset of sensory block was similar in both the bupivacaine and ropivacaine group, which is in variance with our study.

Tejwant Rajkhowa et al[10] (2013-2014) conducted a study using 30 ml of 0.5%ropivacaine alone and 30 ml of 0.5% ropivacaine plus 50 µg of fentanyl. Theyconcluded that addition of fentanyl to ropivacaine delayed the onset of sensory block, which is in accordance with our study. In our study, mean duration of sensory block was more among group I patients as compared to group II patients. It was 684.300±31.92 minute in group I & 568.167±77.03 in group II patients respectively. There was statistically highly significant difference found in mean duration of sensory block between group I and group II (P=0.001)

Anupreet Kaur et al[8] (2012-2013) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% ropivacaine. The duration of sensory block in bupivacaine group was 450.40±54.50 and 421.20±38.33 in ropivacaine group which was highly significant statistically. They concluded that duration of sensory block was greater in bupivacaine group as compared to ropivacaine group, which is similar to our study.

Ranjan R. Venkatesh et al[9] (2010-2012) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5 and 0.75% ropivacaine and concluded that duration of sensory block was greater in bupivacaine group as compared to ropivacaine group, which is similar to our study.

Wasudeo Barsagade et al[11] (2016) conducted a study using 30 ml of 0.5% bupivacaine plus fentanyl 1µg/kg and 30 ml of ropivacaine 0.5% plus 1µgm/kg of fentanyl. The duration of sensory block in bupivacaine group was 644.44±29.85 and 573.46±26.74 in ropivacaine group which is highly significant statistically. They concluded that ropivacaine has a shorter duration of sensory block as compared to bupivacaine, which is similar to our study.

In our study, mean time of onset of motor block was more among group I patients as compared to group II patients. It was 14.467±1.92 minute in group I & 11.067±1.43 in group II patients respectively. There was statistically highly significant difference found in mean time of onset of motor block between group I and group II(P=0.001).

Anupreet Kaur et al[8] (2012-2013) conducted a study using 30 ml of 0.5% bupivacaine and ropivacaine. The onset of motor block in bupivacaine group was 22.92±3.79 and 14.88±3.35 in ropivacaine group. They concluded that onset of motor block was early in ropivacaine group, which is similar to our study.

Shaliendra Modak et al[7] (2016) conducted a study using 30 ml of 0.5% bupivacaine and ropivacaine in 60 patients posted for upper limb surgeries. The onset of motor block was 17.80±3.71 in bupivacaine group and 10.63±2.92 in ropivacaine group. They concluded that ropivacaine has earlier onset of motor block, which is similar to our study.

In our study, mean duration of motor block was more among group I patients as compared to group II patients. It was495.833±92.76 minute in group I & 402.833±93.21 in group II patients respectively. There was statistically highly significant difference found in mean duration of motor block between group I and group II(P=0.001). Wasudeo Barsagade et al[11] (2016) conducted a study using 30 ml of 0.5% bupivacaine plus 1µg/kg fentanyl and 30 ml of 0.5% ropivacaine plus 1µg/kg fentanyl. The duration of motor block was 595.55±32.35 in bupivacaine group and 513.46±24 in ropivacaine group which is highly significant statistically. They concluded that bupivacaine has greater duration of motor block as compared to ropivacaine, which is similar to our study.

Anupreet Kaur et al[8] (2012-2013) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% ropivacaine. The duration of motor block was 408.40±50.39 in bupivacaine group and 365.60±34.29 in ropivacaine group which is highly significant statistically. They concluded that bupivacaine has greater duration of motor block as compared to ropivacaine, which is similar to our study.

Ranjan R. Venkatesh et al[9] (2010-2012) conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5 and 0.75% ropivacaine and concluded that duration of motor block was greater in bupivacaine group as compared to ropivacaine group, which is similar to our study.

Conclusion

In conclusion, combination of bupivacaine and fentanyl provides longer duration of sensory block, motor block and postoperative analgesia then combination of ropivacaine and fentanyl with comparable haemodynamics in both groups and without any major side effects.

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