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A COMPARATIVE STUDY OF ROPIVACAINE 0.5% and BUPIVACAINE 0.5% COMBINED WITH FENTANYL IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

Anaesthesiology

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ABSTRACT

Background: Regional anaesthesia procedures are a valuable combination because to their affordability, safety, early ambulation benefit, and sustained postoperative pain management. **Objectives:** To assess the duration of analgesia, hemodynamic parameters, and complications of 0.5% Ropivacaine and 0.5% Bupivacaine administered in combination with Fentanyl in brachial plexus block through supraclavicular route in upper limb operating rooms. **Material And Method:** This hospital based observational study was conducted in patients who are undergoing upper limb surgeries in a total of 60 patients of 18-65 years of either sex, ASA-grade I/II who underwent elective unilateral upper limb surgery; were randomly divided in to two groups of 30 each - Group BF in whom Bupivacaine 0.5% 29 cc with Fentanyl 50 µg 1 cc was used as local anaesthetic and Group RF who were given Ropivacaine 0.5% 29 cc with Fentanyl 50 µg 1 cc. The supraclavicular technique was used to provide brachial plexus block. The length of analgesia, hemodynamic parameters, the timing of start and duration of sensory and motor blockade, and problems resulting from the aforementioned medications were compared between the two groups. **Results:** The use of ropivacaine reduced the onset time for both sensory and motor blockade. While ropivacaine caused a significantly longer period of sensory block, bupivacaine produced a statistically significantly longer duration of motor block. There was a significant difference in the post-operative visual analogue scale (VAS) score between the two groups, and the RF group had post-operative analgesia for a longer period of time. Heart rate, respiratory rate, mean arterial pressure, and oxygen saturation did not alter in a way that was statistically significant during the study. **Conclusion:** Fentanyl and ropivacaine offer a superior profile when it comes to post-operative analgesia, a prolonged duration of sensory block, and a quick start to motor and sensory block.

KEYWORDS

Supraclavicular, Brachial Plexus Block, Ropivacaine, Bupivacaine Post-Operative Analgesia.

INTRODUCTION

Due to their affordability and safety, regional anaesthetic procedures have become more and more popular recently, making them a valuable toolkit for anaesthesiologists. The benefits of this procedure include avoiding the side effects of general anaesthesia medications, pressure response from laryngoscopy and tracheal intubation, early ambulation[1] and sustained postoperative pain management.[2,3]. Brachial plexus blocks are a valuable substitute for general anaesthesia in upper limb surgery due to their high success rate and capacity to offer sustained pain management after surgery.[4]

Anaesthesia that is comprehensive, dependable, and has a quick onset is achieved by performing it at the trunk level, where the plexus is most compactly presented.[5]. Later, in 1996, ropivacaine, a long-acting local anaesthetic with a superior safety profile than bupivacaine, was approved. When taken in large quantities, it has less toxicity to the central nervous system and less cardiac depression.[6]When fentanyl is co-administered, the duration of post-operative analgesia is prolonged. This is because fentanyl acts directly on the peripheral nervous system and enhances the local anaesthetic activity through central opioid receptor-mediated analgesia.[7]With this background, this study was conducted for brachial plexus block through supraclavicular route using 0.5% Ropivacaine and 0.5% Bupivacaine both combined with fentanyl in upper limb surgeries.

MATERIALS AND METHODS:

A hospital based observational study was done from April two thousand twenty three to may two thousand twenty four involving 60 patients of either sex, ASA-grade I/II, and age group of 18–65 years was carried out in Assam Medical College in the department of orthopaedics, Dibrugarh in after receiving approval from the institutional ethical committee. In this study, elective patients who had unilateral upper limb surgery were enrolled in the study. Patient experiencing local infection or inflammation, hemodynamic instability, allergy to a local anaesthetic medication.

On the day before the procedure consent was obtained. Patients' baseline data, including pulse, blood pressure, respiratory rate, and SPO2, were recorded using standard monitors such as ECG, Non-invasive Blood Pressure (NIBP), and pulse oximeters. Two groups of patients were randomly assigned: Group BF received Bupivacaine 0.5% 29 cc with Fentanyl 50 µg 1 cc as a local anaesthetic, while Group RF received Ropivacaine 0.5% 29 cc with Fentanyl 50 µg 1 cc. Supraclavicular approach was utilized to provide brachial plexus blockade.. Systemic adverse effects were monitored in surgical patients. Every two minutes, the radial, ulnar, and median nerve innervated areas were tested for sensory block onset using a traumatic pin prick test.

Grade 0 sensory blocking was applied if there was no discernible loss of feeling to a pinprick; Grade 1 analgesia was applied if the patient felt touch but not pain upon pinprick; and Grade 2 anaesthesia was applied if the patient felt no touch sensation on pinprick. The duration between administering a medicine and the total loss of sensation was called the "onset time" (sensory score 2). Time from the beginning of the block to the full recovery of paraesthesia (sensory score 0) was used to define the duration of the sensory block. Assessing motor blockade involved asking the patient to raise their arm while maintaining a straight elbow (superior trunk) and to measure their hand's grip strength (middle and inferior trunk).

Three-point rating system was used to assess motor block: grade 0 indicates no weakness in the patient's feet, grade 1 indicates paresis (reduced movement with incapacity to complete tasks against resistance), and grade 2 indicates Patient becomes paralyzed. The duration of the motor blockade was determined by measuring the time from the point of drug injection to the full motor block (motor grade score 2) and the time from the point of complete motor blockade to the restoration of forearm motions (grade 0).

Every parameter was recorded at 5 minutes intervals for fifteen minutes, followed by 15 minutes intervals for 30 minutes, 30 minutes intervals for 60 minutes, 1 hour interval for 2 hours, 2 hour intervals for 12 hours, and 16 hour intervals. We recorded the length of the surgery and the times for tourniquet inflation and deflation. Using a visual analog scale (VAS Score), which ranges from 0 (no pain) to 10 (worst pain), the intensity of post-operative pain was assessed. Following surgery, pain scores were recorded at 30 minutes, 60 minutes, and then every 2 hours until 16 hours. Time of the patient's return to a VAS score of 4 was recorded. If the score was three or lower, the analgesia was deemed adequate. When the VAS score exceeded 4, the analgesia was deemed inadequate, and injections of rescue analgesia were

administered, i.v diclofenac sodium 2 mg/kg. The evaluation was discontinued, and the timing of the first analgesic's requirement was noted. The length of analgesia in both groups was studied by measuring the interval between the start of sensory blockage and the point at which the patient's VAS score was greater than 4. The significance level was set at $p < 0.05$, and the P value was determined using the Graph Pad software.

RESULTS:

The data analysis revealed that there was no statistically significant difference between the two groups, indicating that they were comparable in terms of age, sex, and weight (Table 1). The majority of patients underwent K-wire, platting, nailing implant removal, external fixator, and upper limb debridement, all of which were comparable across groups. There was no statistically significant difference in the duration of operation between the two groups (Table 1). The minimum amount of time needed for surgery was 30 minutes for Group RF and 35 minutes for Group BF. The maximum amount of time for surgery in Group BF was 160 minutes, and in Group RF it was 150 minutes. The RF group had a shorter onset time for sensory and motor blockade than the BF group, with a statistically significant p value of less than 0.05. In group RF, the mean onset time was 12.73 ± 2.60 minutes, but in group BF, it was 16.87 ± 2.80 minutes. In group RF, the mean onset time was 16.93 ± 3.27 minutes, but in group BF, it was 19.30 ± 2.39 minutes (Table 2). The RF group experienced a longer sensory block duration than the BF group, and this difference was highly statistically significant (P value <0.05). Among groups RF and BF, the mean duration of sensory block was 11.86 ± 2.16 hours and 9.93 ± 1.62 hours, respectively. In comparison to the RF group, the BF group experienced a longer motor block duration, and this difference was highly statistically significant (p value < 0.05). The motor block mean duration was 6.45 ±1.19 hours in group RF and 7.56 ±1.47 hours in group BF (Table 2). The post-operative VAS score showed a significant difference between the two groups. (Figure 1) Group RF experienced much longer post-operative analgesia than group BF, and this difference was statistically significant (P < 0.05). Group RF experienced postoperative analgesia for an average of 13.52 ± 1.71 hours, but group BF experienced it for an average of 11.77 ± 1.68 hours. This difference was statistically significant ($p < 0.05$). The study found that there was no significant fluctuation in the pulse rate, blood pressure (both systolic and diastolic), SPO2, or respiratory rate in any of the study groups. There was also no any significant intra-operative and post-operative complications like intra-arterial or intravascular placement of drug, pneumothorax, nausea, vomiting, pruritus, neurotoxicity or cardiotoxity were found in both the groups.

Table 1: Demographic comparison of both the study groups

Variables	Group RF (n=30) (Mean ± SD)	Group BF (n=30) (Mean ± SD)	P value
Age (in years)	38.83 ± 14.31	39.67 ± 14.44	>0.05
Weight (in kg)	61.00 ± 10.57	61.27 ± 8.41	>0.05
Sex Ratio (M : F)	22 : 08	23 : 07	-
Duration of Surgery (mins)	85.70 ± 35.37	84.60 ± 34.83	>0.05

Table 2: Characteristics of sensory and motor blocks in both the groups

	Onset Time (in minutes) (Mean ± SD)		Duration of block (in hr) (Mean ± SD)	
	Sensory Block	Motor Block	Sensory block	Motor block
Group RF (n=30)	12.73 ± 2.60	16.93 ± 3.27	6.45 ± 1.19	11.86 ± 2.16
Group BF (n=30)	16.87 ± 2.80	19.30 ± 2.39	7.56 ± 1.47	9.93 ± 1.62
P value	<0.0001*	0.0022*	0.0002*	0.0023*

*significant

Figure 1: Post-operative visual analogue score (VAS) in both the groups

DISCUSSION:

This study evaluated the effectiveness of Ropivacaine, a more recent local anaesthetic drug, to Bupivacaine in brachial plexus block in 60 patients of different ages and sex who were classified as ASA Risk I and II for upper limb surgery. The age, body weight, gender, kind of operation, and duration of surgery did not show statistically significant intergroup differences in the current study. When compared to the BF group, the RF group experienced a noticeably faster onset of sensory block and motor block. This discrepancy may arise from the fact that motor impulses travel through large A fibers, while pain impulses travel through small myelinated A fibers and small unmyelinated C fibers.[8]The physicochemical characteristics of each medication, such as its pKa and lipid solubility, determine whether or not it can block nerve fibers.[9]Although the pKa of the two medications is the same, Bupivacaine is predicted to block nerve fibers more slowly than Ropivacaine due to its lower lipid solubility. Hence, bupivacaine causes a slower sensory and motor block than ropivacaine at the same volumes and concentrations. Studies conducted by Casati et al., Tripathi et al., and Raikwar et al. produced similar findings.[10-12]In this investigation, the RF group's duration of sensory block was much longer than that of the BF group, but the RF group's duration of motor block was significantly shorter than that of the BF group, which is consistent with a study by Tripathi et al[11]. The duration of both motor block and sensory block was statistically longer for ropivacaine than for bupivacaine in a study by Raikwar et al.[12] The results differ from those of our investigation. The length of post-operative analgesia was considerably longer in our trial with the Ropivacaine + fentanyl group than in the Bupivacaine + fentanyl group, which is consistent with studies by Raikwar et al. and Casati et al.[10,12]

CONCLUSION:

The results of this study indicate that ropivacaine, when combined with fentanyl, has a better profile of action, exhibiting a quick onset of both sensory and motor block,prolonged duration of sensory block and post-operative analgesia and can be proposed as a better alternative to Bupivacaine along with fentanyl for brachial plexus block in upper limb surgeries.

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