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Original Research Paper

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TO COMPARE THE TWO ADJUVANTS, DEXMEDETOMIDINE AND FENTANYL, IN TERMS OF EFFICACY, DURATION OF POSTOPERATIVE ANALGESIA AND ANY SIDE EFFECTS.

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ABSTRACT This study aimed to compare the efficacy, duration of postoperative analgesia, and side effects of dexmedetomidine and fentanyl when added to ropivacaine for ultrasound-guided supraclavicular brachial plexus block in adult patients undergoing elective orthopedic surgeries of the elbow, forearm, and hand. A total of 80 patients were randomly assigned to two groups: Group A (dexmedetomidine) and Group B (fentanyl), with 40 patients in each group. The patients received 30 mL of 0.5% ropivacaine, combined with either 1 g/kg dexmedetomidine (Group A) or 1 g/kg fentanyl (Group B). The onset and duration of sensory and motor blocks were recorded, as well as postoperative analgesia and any complications. The results showed no significant difference between the two groups' onset of sensory and motor blocks. However, dexmedetomidine significantly prolonged the duration of both sensory (801.75 ± 46.07 min vs. 590.25 ± 40.41 min) and motor blocks (649.5 ± 42.73 min vs. 456.75 ± 32.93 min) compared to fentanyl ($p < 0.0001$). Group A experienced a higher incidence of bradycardia (12.5%) and sedation (15%) compared to Group B ($p = 0.025$ for sedation). The groups had no significant differences in nausea, vomiting, or hypotension. In conclusion, dexmedetomidine is an effective adjuvant to ropivacaine for supraclavicular brachial plexus block, providing prolonged sensory and motor blockade, with a mild increase in sedation and bradycardia but no major adverse effects.

KEYWORDS : Brachial plexus block, Ropivacaine. Dexmedetomidine, Fentanyl, Ultrasound guidance

INTRODUCTION

For procedures involving the upper limbs, a brachial plexus block ensures sufficient relaxation of the muscles and steady perioperative haemodynamics.[1] The long-acting amide local anaesthetic ropivacaine is less harmful to the heart and has a better safety profile compared to bupivacaine.[2,3] To improve the quality of anaesthesia and local anaesthesia while maintaining a prolonged block, adjuvants have been provided.[4] For the best possible block success rates, the current study used ultrasound (USG) guidance during the procedure. Examining the effectiveness, duration of postoperative analgesia, and adverse effects of the two adjuvants, dexmedetomidine and fentanyl, was the goal of the current study.

Methods

Two groups, each consisting of forty adults, were selected at random from a computerised random number table. The study comprised male and female patients with ASA grades I and II who were 18–60 years old and had elective orthopaedic procedures on their elbows, forearms, or hands.

Participants were not included if they had a coagulopathy, were using anticoagulants, had a severe illness of the kidneys, liver, lungs, or heart, had an infection at the block site, were pregnant, or had a neuromuscular problem. Additionally, patients who refused to receive ropivacaine, dexmedetomidine, or fentanyl were not included in the study.

The patients in group A were given 30 mL of a mixture of 0.5% ropivacaine and 1 μg kg−1 of dexmedetomidine, while the patients in group B were given 30 mL of a similar mixture under USG guidance, with 0.5 ropivacaine and 1 μg kg−1 of fentanyl.

A thorough patient history, physical examination, systemic evaluation, evaluation of the airway, and standard laboratory tests were all part of the preoperative evaluation. These tests included haemoglobin, total and differential white blood cell counts, bleeding and clotting times, platelet counts, blood glucose, serum creatinine, and blood urea. Additionally, a chest X-ray and electrocardiogram were conducted. To guarantee that all patients were fasting for at least 8 hours before to surgery, they were all given 0.5 mg tabs of alprazolam to take orally the night before. The patient was educated about the block process and how to interpret their Visual Analogue Scale (VAS) result. Vital signs and values were documented before the operation. Intravenous ringers were started after an 18G cannula was used to secure the line. The premedication consisted of injecting 4 mg of ondansetron intravenously, 50 mg of ranitidine intravenously, and 0.03 mg of midazolam kg−1 intravenously. Following the implementation of aseptic procedures, 1 millilitre of 2% lignocaine was injected into the skin. Volume and adjuvant were adjusted for each study group during supraclavicular brachial plexus blocks guided by ultrasound (SonoSite) using the in-plane approach. At5,10,15,20, and 30 minute intervals until total sensory or motor blockage occurred, the start of blockage was evaluated. The beginning of sensory block was determined by measuring the time from when the local anaesthesia injection was finished to when it was identified using a pinprick method. The time it took to go from finishing the local anaesthetic injection to getting a score of 3 on the modified Bromage scale was used to determine when motor block began. Patients were not included in the trial if, after 30 minutes of medication delivery, it was determined that the anaesthesia was insufficient. At 1, 2, 3, 5, 12, and 24 hours, the length of the sensory and motor block was measured. From the time complete sensory block began until postoperative pain symptoms manifested and rescue analgesia was administered, we calculated the overall duration of sensory block. The length of motor blockade was determined by adding up the time it took for motor activity to fully recover after the blockage began. The Ramsay Sedation Scale was used to measure the level of sedation. A heart rate less than 50 beats per minute and blood pressure less than 30% of the initial values were used to determine bradycardia. Intravascular injection, arrhythmias, pneumothorax, and paresis were among the complications that were recorded. Various physiological parameters were monitored on a 5-minute, 30-minute, and 30-minute intervals until the block retreated. Administer 75 mg of diclofenac intravenously over 30 minutes

as a rescue analgesic for patients with a VAS score of 4 cm or higher. Additional analgesia was administered through intravenous infusions of 2 mg kg−1 tramadol and 1 g of paracetamol if the pain did not go away after 2 hours of infusion. Medications administered in a 24-hour period were recorded.

RESULTS

Baseline Characteristics

Both Group A (fentanyl) and Group B (dexmedetomidine) had comparable patient characteristics at baseline. The average age in Group A was 39.5 ± 13.41 years, while in Group B it was 38.4 ± 11.35 years (p = 0.693). In Group A, the average weight was 59.5 ± 6.33 kg, while in Group B, it was 58.42 ± 6.17 kg (p = 0.5731). Group A and Group B had similar gender distributions, with 20 men and 15 females in Group A and 21 men and 24 females in Group B, respectively (p = 0.3709). With respect to ASA grade, thirty-two patients in Group A and thirty-two in Group B were deemed ASA I, ten in Group A and eight in Group B were deemed ASA II (p = 0.7889).

Motor and Sensory Block

Group A and Group B did not differ significantly in the beginning of sensory (13.95 ± 1.34 min for Group A and 14.18 ± 1.41 min for Group B, p = 0.454 and 24.25 ± 1.56 min and 24.38 ± 1.46 min and p = 0.776, respectively) and motor blocks. The sensory block in Group A (dexmedetomidine) lasted much longer than in Group B (fentanyl) (801.75 ± 46.07 min vs. 590.25 ± 40.41 min, p < 0.0001), and the motor block was also significantly longer in Group A (649.5 ± 42.73 min vs. 456.75 ± 32.93 min, p < 0.0001), as shown in Table 2.

Complications

Bradycardia (12.5%) and sedation (15%) were more common in Group A than in Group B (fentanyl), with the difference being statistically significant (p=0.025) for sedation. In terms of nausea/vomiting (7.5% in Group A vs. 5% in Group B, p = 0.876) and hypotension (2.5% in Group A vs. 0% in Group B, p = 0.976), there were no significant differences between the groups.

DISCUSSION

We examined the effects of two adjuvants added to ropivacaine in a USG-guided supraclavicular brachial plexus block on intraoperative and postoperative anaesthesia in this study. Their duration of action is shorter when used only as local anaesthesia.[6] While indwelling catheters can lengthen the time that local anaesthesia alone provides analgesia, they also pose the risks of migration, infection, and misplacement.[7,8] Benefiting from a longer duration of action without the need for an additional surgery and the hazards of catheter placement, adjuvants to local anaesthesia offer this advantage.[9] Opioid and non-opioid adjuvants have been utilised for supraclavicular blocks to prolong analgesia and reduce systemic analgesia usage.[10,11]

Dexmedetomidine acts as an analgesic by activating peripheral α2 adrenoceptors, which are located in the brain. Another α2 agonist that acts centrally and is less selective than clonidine has also been employed as a supplement to local anaesthesia.[12–14] Hypothesised mechanisms of action for dexmedetomidine include activation of inwardly rectifying G1 protein-gated potassium channels, leading to membrane hyperpolarisation and decreased excitability of central nervous system cells, and reduction of calcium conductance into cells, inhibiting neurotransmitter release. The impact of combining bupivacaine with dexmedetomidine.[15] and.[16] levobupivacaine.[17,18] is effective and leaves patients with no neurological impairments after surgery.

Fentanyl is an opioid analgesic that is both powerful and short-lived. It has a significant agonistic effect at the μ-opioid receptor. When administered in conjunction with peripheral nerve blocks, fentanyl enhances the analgesic effects of local anaesthesia by increasing its absorption into the systemic circulation through central opioid receptor-mediated mechanisms.[19] The current research utilised a combination of 1 μg kg−1 of fentanyl and 30 mL of 0.5% ropivacaine. Both groups experienced sensory and motor blockage at about the same time after surgery, but dexmedetomidine considerably extended postoperative analgesia compared to fentanyl.

Marhofer et al.[20] combined ropivacaine with dexmedetomidine as an adjuvant in a USG-guided ulnar nerve block demonstrated a reduction in the time to motor block onset without affecting the time to sensory block onset. The sensory block and the motor block both lasted for a long time.

Yoshitomi et al.[21] investigated male guinea pigs given a combination of lidocaine and alpha-2 adrenoceptor agonists such as dexmedetomidine, clonidine, and oxymetazoline. Research has shown that adrenoceptor agonists can increase the local anaesthetic effect of lidocaine in a way that is dose-dependent.

Rancourt et al.[22] administered a tibial nerve block guided by ultrasound to 14 healthy volunteers in a prospective, randomised, controlled, double-blind crossover study. Researchers looked at ropivacaine both on its own and in conjunction with dexmedetomidine. The duration of sensory blockade is prolonged when dexmedetomidine is given to ropivacaine for a tibial nerve block.

Das et al.[23] investigated the impact of combining ropivacaine with dexmedetomidine for supraclavicular brachial plexus blockade in 84 patients scheduled for elective hand and forearm operations. Dexmedetomidine has a longer duration of action and an earlier onset of block compared to ropivacaine alone. Multiple studies.[24–26] Research has demonstrated that dexmedetomidine is a safe and effective adjuvant when used in conjunction with ropivacaine for peripheral nerve blocks.

CONCLUSION

Using dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus blocks increases the duration of sensory and motor blocks and postoperative analgesia compared to fentanyl. It is safe and does not cause serious adverse events.

Table 1: Baseline Characteristics

Baseline characteristics	Group A	Group B	P value
Age (years)	39.5±13.41	38.4±11.35	0.693
Weight (kg)	59.5±6.33	58.42±6.17	0.5731
Gender			
Male	20	21	0.3709
Female	15	24	
ASA grade			
I	30	32	0.7889
II	10	08	

Table 2: Motor and Sensory Block

Blocks	Group A	Group B	P value
Onset of sensory block	13.95±1.34	14.18±1.41	0.454
Duration of sensory block	801.75±46.07	590.25±40.41	<0.0001
Onset of motor block	24.25±1.56	24.38±1.46	0.776
Duration of motor block	649.5±42.73	456.75±32.93	<0.0001

Table 3:

Complications	Group A	Group B	P value
Bradycardia	5 (12.5%)	0 (0%)	0.054
Nausea/vomiting	3 (7.5%)	2 (5%)	0.876
Hypotension	1 (2.5%)	0 (0%)	0.976
Sedation	6 (15%)	0 (0%)	0.025

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