



DEXMEDETOMIDINE AND FENTANYL AS ADJUVANTS TO ROPIVACAINE ON ANALGESIC EFFICACY IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT **Background:** While general anesthesia has long been the standard for surgeries involving the upper limbs, regional anesthesia has recently become more popular owing to its many benefits, including better postoperative pain management, lower costs, and fewer complications. This research set out to determine whether the analgesic efficacy of supraclavicular brachial plexus blocks containing ropivacaine and the adjuvants dexmedetomidine and fentanyl were significantly different. **Methods:** Participating in this prospective, randomized study were fifty adults scheduled for elective procedures involving the elbow, forearm, or hand at a tertiary care facility. One group of patients was given 30 mL of 0.5% ropivacaine with 1 µg/kg dexmedetomidine, and the other group received the same amount of ropivacaine with 1 µg/kg fentanyl. The patients were randomly assigned to either Group A or Group B. We tracked and analyzed the beginning and end times of motor and sensory blocks, as well as the occurrence of side effects. **Results:** The two groups started off with comparable characteristics. In comparison to Group B, which had onset times of 16.78 ± 4.57 minutes for sensory and 28.39 ± 6.78 minutes for motor blocks, with P-values < 0.001 , Group A exhibited noticeably faster times (12.67 ± 2.56 minutes) and times (22.67 ± 4.34 minutes) for both types of blocks. The sensory and motor blocks in Group A lasted substantially longer (790.65 ± 54.77 minutes and 610.45 ± 58.76 minutes, respectively) than in Group B (545.33 ± 50.32 minutes for sensory and 412.43 ± 42.98 minutes, respectively), with p-values less than 0.001. While bradycardia, nausea, and hypotension were more common in Group A, no statistically significant differences in side effects were seen across the groups ($P = 0.51$). **Conclusion:** When ropivacaine and dexmedetomidine were combined, the sensory and motor blocks were both longer lasting and started sooner than when fentanyl was used alone. Neither adjuvant had a significantly different adverse impact profile, though. In supraclavicular brachial plexus anesthesia, these results point to dexmedetomidine as a superior adjuvant for extending nerve blocks.

KEYWORDS : Dexmedetomidine, Fentanyl, Ropivacaine, Supraclavicular brachial plexus block, Onset of block

INTRODUCTION

The traditional method of performing upper limb operations under general anesthesia has given way to regional anesthesia as a result of the rising expense of anesthetic agents, the risks of their side effects (such as nausea, vomiting, dry mouth, sore throat, hoarseness, shivering, dizziness, post-operative cognitive dysfunction, etc.), and the challenges posed by operating room pollution.¹ An additional benefit of regional anaesthesia is the alleviation of postoperative discomfort. When the patient's overall health is bad, when they aren't ready, or when there are other health issues, like uncontrolled diabetes, heart disease, or lung illness, regional method is always better. Additionally, it is helpful when the patient wants to stay conscious during surgery and needs to be able to walk around afterward.²

Their duration of action is shorter when used only as local anesthesia. While indwelling catheters can lengthen the time that local anesthesia alone provides analgesia, they also pose the risks of migration, infection, and misplacement.^{3,4} Benefiting from a longer duration of action without the need for an additional surgery and the hazards of catheter placement, adjuvants to local anesthesia offer this advantage.⁵ The purpose of using adjuvants, such as opioids and non-opioids, for supraclavicular blocks is to prolong the analgesic effect and reduce the need for systemic analgesics.^{6,7}

Ropivacaine, an amide-linked local anesthetic with a S (–) enantiomer, has a lower risk of cardiotoxicity and CNS toxicity compared to bupivacaine because it is less lipophilic.^{8–10} A higher level of motor sensory differentiation is attained because it has less lipophilicity and thus less penetration of big, myelinated nerve fibers.

The purpose of this research was to determine the analgesic effectiveness of ropivacaine with and without dexmedetomidine and fentanyl added to it in a supraclavicular brachial plexus block.

METHODS

This prospective investigation was carried out in the anesthesia department of a tertiary care facility. Two groups, each consisting of 25 adults, were selected at random from a computerized random number table. The study comprised male and female patients (ranging in age from 18 to 60 years old) who had undergone elective surgery on their elbow, forearm, or hand and had an American Society of

Anesthesiologists (ASA) grade of I or II. The study did not include patients who had coagulopathies or were taking anticoagulants; had severe renal, hepatic, pulmonary, or cardiac problems; had an infection at the block site; was pregnant; or had neuromuscular abnormalities. Exclusion criteria also included patient refusal and any known adverse reactions to ropivacaine, dexmedetomidine, or fentanyl.

Participants in group A were given 30 mL of a 0.5% ropivacaine solution containing 1 µg kg⁻¹ of dexmedetomidine, whereas those in group B were given the same solution containing 1 µg kg⁻¹ of fentanyl, administered via a supraclavicular brachial plexus block. A thorough patient history, physical examination, systemic evaluation, evaluation of the airway, and any required routine investigations were all part of the preoperative evaluation. To guarantee that all patients were fasting for at least 8 hours before surgery, they were all given 300 mg of ranitidine and 0.5 mg of alprazolam orally the night before. The patient was educated on the block process. Recordings of vital signs and values were made before surgery. An 18G cannula was used to secure the intravenous line. A premedication injection of 4 mg of ondansetron and 50 mg of ranitidine were administered intravenously.

We calculated the entire length of sensory block as the time it took for the Holmen scale 3 sensory block to begin and for pain to manifest. The length of the motor blockade was determined by adding up the time it took for the Holmen scale 3 motor blocks to start and for motor activity to fully recover.

Definition of Bradycardia: heart rate less than 60 beats per minute and blood pressure less than 20% of the initial values. There were complications such as arrhythmias, pneumothorax, paresis, and intravascular injection. From 5 minutes until 30 minutes, and then every 15 minutes until the block retreated, vital signs such as heart rate, respiration rate, blood pressure, and oxygen saturation were monitored.

Statistical Analysis

The data analysis was carried out using IBM's social science statistics software, version 23. A chi-squared test or Fisher's Exact Test was used when researchers compared groups of people using categorical data. Results were considered statistically significant if the p-value was less than 0.05.

RESULTS

Baseline characteristics

The baseline characteristics of Group A (n=25) and Group B (n=25) were compared, with no significant differences observed between the two groups in terms of age ($P=0.241$), gender ($P=0.382$), weight ($P=0.767$), and ASA grade distribution ($P=0.394$). Specifically, the mean age, gender distribution, and weight were similar between the groups, as were the proportions of patients in ASA Grade I and Grade II. All P-values indicate that the differences observed were not statistically significant (Table 1).

Table 1: Baseline Characteristics

Baseline characteristics	Group A(n=25)	Group B (n=25)	P value
Mean age (years)	38.34±11.25	43.56±12.67	0.241
Gender			
Male	14	17	0.382
Female	11	8	
Weight (kg)	63.45±6.78	65.98±7.43	0.767
ASA grade			
Grade I	13	10	0.394
Grade II	12	15	

Onset of Blocks

Table 2 shows that the, Group A had significantly faster onset times for both sensory (12.67 ± 2.56 minutes) and motor (22.67 ± 4.34 minutes) blocks compared to Group B (sensory: 16.78 ± 4.57 minutes, motor: 28.39 ± 6.78 minutes), with P-values of <0.001 for both comparisons.

Table 2: Onset Of Blocks

Onset of Blocks (min)	Group A(n=25)	Group B (n=25)	P value
Sensory	12.67±2.56	16.78±4.57	<0.001
Motor	22.67±4.34	28.39±6.78	<0.001

Duration of Blocks

Table 3 shows that the, Group A had significantly longer sensory (790.65 ± 54.77 minutes) and motor (610.45 ± 58.76 minutes) block durations compared to Group B (sensory: 545.33 ± 50.32 minutes, motor: 412.43 ± 42.98 minutes), with P-values of <0.001 for both

Table 3: Duration of Blocks

Duration of Blocks (min)	Group A(n=25)	Group B (n=25)	P value
Sensory	790.65±54.77	545.33±50.32	<0.001
Motor	610.45±58.76	412.43±42.98	<0.001

Adverse effects

There were no significant differences in adverse effects between Group A and Group B ($P=0.501$). Both groups had similar numbers of cases with no adverse effects. Group A had slightly higher incidences of bradycardia (2 vs 3), nausea (1 vs 2), and hypotension (4 vs 1), but these differences were not statistically significant.

Table 4: Adverse Effects

Adverse effects	Group A(n=25)	Group B (n=25)	P value
Nil	18	19	0.501
Bradycardia	2	3	
Nausea	1	2	
Hypotension	4	1	

DISCUSSION

Brachial plexus block provides adequate muscular relaxation and maintains stable perioperative hemodynamics for upper limb surgeries.¹¹ Ropivacaine, a long-acting amide local anesthesia, has better safety profile than bupivacaine with reduced cardiotoxic effects.^{12,13} Adjuvants have been administered to achieve prolonged block with improved quality of anesthesia and local anaesthesia.^{1,2}

Dexmedetomidine is a centrally acting α_2 agonist mediating antinociception via peripheral α_2 adrenoceptors. The effect of the addition of dexmedetomidine to ropivacaine has been studied and found to be effective with no postoperative neurological deficits.^{4,9,10}

Fentanyl, a potent synthetic opioid analgesic with a strong agonistic action at the μ -opioid receptor with a rapid onset and short duration of action when added to local anesthesia in peripheral nerve blocks, potentiates the local anesthesia action via central opioid receptor-

mediated analgesia by the peripheral uptake of fentanyl to the systemic circulation. The effect of fentanyl as adjuvant with ropivacaine has been studied and found to be effective with no side effects.^{6,8-13}

The present study recorded the onset of sensory blockade as 12.67 ± 2.56 min in the dexmedetomidine group (Group A) and 16.78 ± 4.57 min in the fentanyl group (Group B) with P value of <0.0001 . This result is consistent with the observation of **Dharmarao PS et al** who observed that the onset of sensory blockade was 13.95 ± 1.34 min in group A and 14.18 ± 1.41 min in group B.¹⁴

The onset of motor blockade was 22.67 ± 4.34 min in the dexmedetomidine group (Group A) and 28.39 ± 6.78 min in the fentanyl group (Group B) with P value of <0.001 in our study, and this result is inconsistent with the observation of **Dharmarao PS et al** who observed that the onset of motor blockade was 24.25 ± 1.56 min in group A and 24.38 ± 1.46 min in group B with P value of 0.776.¹⁴ But our study findings are consistent with the observation of **Kauret al** who observed that the onset of motor blockade is faster in dexmedetomidine group (8.075 ± 0.27 min) when compared to fentanyl group (9.738 ± 0.54 min) with P value of <0.001 .¹⁵

The duration of sensory block in our study was significantly prolonged in dexmedetomidine group (790.65 ± 54.77 min) as compared to fentanyl group (545.33 ± 50.32 min) with P value of <0.001 . This result is consistent with the observation of **Dharmarao et al** who observed that the duration of sensory block was 801.75 ± 46.07 min in dexmedetomidine group and 590.25 ± 40.41 min in fentanyl group with P value of <0.0001 .¹⁴

The duration of motor block was significantly prolonged in dexmedetomidine group (610.45 ± 58.76 min) as compared to fentanyl group (412.43 ± 42.98 min) with P value of <0.0001 in the present study and the result is also consistent with the observation of **Dharmarao et al** who observed that the duration of motor block was 649.56 ± 42.73 min in dexmedetomidine group and 456.75 ± 32.93 min in fentanyl group with P value of <0.0001 .¹⁴

CONCLUSION

The study found that Group A had a significantly faster onset time and longer duration for both sensory and motor blocks compared to Group B. However, the baseline characteristics between the two groups were similar, and there were no significant differences in adverse effects between the groups. Both groups experienced comparable rates of adverse events, with only minor differences that were not statistically significant. Therefore, while Group A demonstrated superior block characteristics in terms of onset and duration, the safety profile in terms of adverse effects was similar between the two groups.

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