Original Research

A PROSPECTIVE RANDOMIZED DOUBLE-BLIND STUDY COMPARING DEXAMETHASONE AND DEXMEDETOMIDINE AS ADJUVANTS TO ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Supraclavicular brachial plexus block is a commonly used regional anaesthetic technique for upper limb surgeries. The addition of adjuvants to local anaesthetics is known to improve block characteristics and prolong postoperative analgesia. This study was designed to compare dexamethasone and dexmedetomidine as adjuvants to ropivacaine.

Methodology: This prospective randomized double-blind study was conducted in 108 patients undergoing upper limb surgeries. Patients were randomly allocated into two groups: Group A received 0.5% ropivacaine with dexamethasone and Group B received 0.5% ropivacaine with dexmedetomidine for supraclavicular brachial plexus block under ultrasound guidance. Onset and duration of sensory and motor block, duration of analgesia, haemodynamic parameters, sedation, and adverse effects were assessed. Statistical analysis was performed using SPSS software, and p-value <0.05 was considered significant.

Results: Group a showed significantly faster onset of sensory and motor block compared to Group B. The duration of sensory and motor blockade and total duration of analgesia were significantly longer in Group A. Time to first rescue analgesic was also prolonged in Group A. Sedation was observed only in Group B. Haemodynamic parameters and adverse effects were comparable between both groups.

Conclusion: Dexamethasone is a more effective adjuvant than dexmedetomidine to ropivacaine in supraclavicular brachial plexus block, providing faster onset and prolonged analgesia with minimal side effects.

Keywords: Supraclavicular Brachial Plexus Block, Dexamethasone, Dexmedetomidine, Ropivacaine, Regional Anaesthesia.

INTRODUCTION

Supraclavicular brachial plexus block is a widely used regional anaesthetic technique for surgeries involving the upper limb, particularly those of the forearm and hand. It provides dense anaesthesia and reliable surgical conditions by targeting the brachial plexus at a compact anatomical location where the neural elements are closely arranged. This anatomical advantage allows effective blockade with relatively small volumes of local anaesthetic, resulting in rapid onset and excellent coverage, including effective tourniquet tolerance during upper limb procedures.[1]

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Peripheral nerve blocks have gained increasing popularity as part of multimodal anaesthesia strategies due to their ability to provide superior perioperative analgesia, reduce systemic opioid requirements, and facilitate early postoperative recovery.[2] However, the duration of analgesia achieved with local anaesthetics alone may be limited, often necessitating additional analgesic supplementation in the postoperative period. To overcome this limitation, various adjuvants have been studied to prolong block duration, enhance block quality, and improve patient satisfaction.

Commonly used adjuvants include dexmedetomidine, dexamethasone, opioids, clonidine, neostigmine, and tramadol, among others.[3] These agents act through different mechanisms such as modulation of nociceptive transmission, anti-inflammatory effects, peripheral vasoconstriction reducing systemic absorption of local anaesthetic, and direct action on nerve fibers.[4]

The addition of such adjuvants to local anaesthetic solutions has been shown to improve the onset time,

prolong sensory and motor blockade, and reduce overall perioperative analgesic consumption.[5]

Ropivacaine, a long-acting amide local anaesthetic, has become increasingly preferred for peripheral nerve blocks due to its favourable safety profile, reduced cardiotoxicity, and lower potential for motor blockade compared to bupivacaine.[6] its differential blockade properties make it particularly suitable for day-care surgeries where early mobilisation is desirable. However, despite these advantages, the relatively shorter duration of analgesia remains a limitation when used alone in brachial plexus blocks.

Dexmedetomidine, a highly selective alpha-2 adrenergic agonist, has been widely investigated as an adjuvant in regional anaesthesia due to its sedative, analgesic, and sympatholytic effects. It enhances analgesia by inhibiting norepinephrine release and modulating pain pathways at the spinal and peripheral levels.[7] On the other hand, dexamethasone, a potent corticosteroid, has demonstrated significant efficacy in prolonging analgesia when used as an adjuvant in peripheral nerve blocks, likely through its anti-inflammatory effects and modulation of nociceptive transmission.[8] Both agents have shown promising results in extending block duration and improving postoperative pain control.

Despite multiple studies evaluating individual adjuvants, there remains ongoing debate regarding the superiority of dexamethasone versus dexmedetomidine when used with ropivacaine in supraclavicular brachial plexus block. Comparative evidence is still evolving, particularly in terms of onset time, duration of analgesia, haemodynamic stability, and side effect profile.

Therefore, the present study was undertaken to compare the efficacy of dexamethasone and dexmedetomidine as adjuvants to ropivacaine in supraclavicular brachial plexus block, with the aim of identifying the superior agent in terms of block characteristics, postoperative analgesia, and safety profile.

Aim

To compare the efficacy of dexamethasone and dexmedetomidine as adjuvants to ropivacaine in supraclavicular brachial plexus block for upper limb surgeries.

Objectives

1. To compare the onset time of sensory and motor blockade between dexamethasone and dexmedetomidine groups.
2. To evaluate the duration of sensory and motor blockade in both study groups.

METHEDOLOGY

This prospective randomized double-blind study was conducted in the Department of Anaesthesiology at Sree Mookambika Institute of Medical Sciences, Kulasekharam, from March 2025 to November 2026 after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. Patients belonging to American Society of Anesthesiologists (ASA) physical status I and II, scheduled for elective upper limb surgeries under supraclavicular brachial plexus block, and willing to participate in the study were included. Patients refusing supraclavicular brachial plexus block, those with coagulopathy or bleeding disorders, local infection at the injection site, hypersensitivity to amide local anaesthetics or dexmedetomidine, cardiac conduction blocks, patients on β-adrenergic blockers or antiplatelet therapy, body mass index >35 kg/m², uncontrolled diabetes mellitus, significant cardiopulmonary disease, or psychiatric illness were excluded from the study. The study purpose was explained to all patients in their local language and written informed consent was obtained prior to enrolment. A detailed pre-anaesthetic evaluation including clinical history, examination, and routine investigations such as complete blood count, serum creatinine, and electrocardiogram (ECG) was performed. Patients were kept nil per oral for 6 hours preoperatively. After confirming fitness for surgery, patients were randomly allocated into two groups using computer-generated randomization, and allocation concealment was maintained. Group A received 20 mL of 0.5% ropivacaine with dexamethasone, while Group B received 20 mL of 0.5% ropivacaine with dexmedetomidine. All blocks were performed under ultrasound guidance using a high-frequency linear probe, with real-time visualization of local anaesthetic spread around the brachial plexus by an anaesthesiologist blinded to group allocation. Standard monitors including ECG, non-invasive blood pressure, pulse oximetry (SpO_2), and heart rate were applied, and baseline values were recorded. All patients received oxygen via nasal cannula at 2 L/min and were premedicated with intravenous midazolam 1 mg and fentanyl 30 µg. Hemodynamic parameters were monitored at regular intervals throughout the procedure and postoperatively. Outcome parameters included onset and duration of sensory and motor block, duration of analgesia assessed using the Visual Analog Scale (VAS), sedation assessed using the Ramsay Sedation Scale, and total analgesic consumption. Rescue analgesia with intramuscular diclofenac (1.5 mg/kg) was administered when VAS score exceeded 4, and time to first rescue analgesic was recorded. Data were entered into Microsoft Excel and analyzed using SPSS version 23.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentages. Intergroup comparisons were performed using independent sample t-test for continuous variables

and chi-square test for categorical variables, with a p-value <0.05 considered statistically significant.

RESULT

In present study, 108 patients were studied, 54 patients received 20 ml 0.5% Ropivacainewith 50 mcg Dexamethasone (Group A, n=54), while other 54 patients received 20 ml 0.5% Ropivacaine with 50 mcg Dexmedetomidine (Group B, n=54). Age, weight, gender, ASA grade & duration of surgery were comparable in both groups.

Table1: General characteristics

Characteristics	Groupa (N=54) Mean ± SD/No. Ofpatients (%)	Groupb (N=54) Mean ± SD/ No. Of Patients (%)	P Value
Age(Years)	36.35 ± 7.23	35.57 ± 8.68	0.74
Height (Cm)	167.2±7.9	165.2±10.1	0.317
Weight(Inkg)	59.96 ± 11.36	62.14 ± 10.46	0.52
Gender			
Male	45(83.33 %)	43(79.63 %)	1.146
Female	9(16.67 %)	11(20.37 %)	
Asa			
Gradei	42(77.78 %)	44(81.48 %)	1.24
Gradeii	12(22.22 %)	10(18.52 %)	
Durationofsurgery (Min)	63.16 ± 21.68	67.37 ± 20.26	0.437

Dexamethasone group has earlier onset of sensory block (10.58 ± 3.24 min vs 12.14 ± 3.12 min), Earlier onset of motor block (13.24 ± 3.58 min vs 16.24 ± 4.18 min), prolongedduration of sensory block (732.95 ± 51.51 min vs 664.82 ± 59.36 min) & prolonged duration of motor block (829 ± 45.72 min vs 733.82 ± 42.58 min) as compared to dexmedetomidine group & difference was statistically significant (p< 0.05).

Table2: Comparison of sensoryand motorblock characteristics.

Characteristics	Groupa(Mean ± SD)	Groupb(Mean ± SD)	P Value
Onsetofsensoryblock(Min)	10.58 ± 3.24	12.14 ± 3.12	0.033
Onsetofmotor Block(Min)	13.24 ± 3.58	16.24 ± 4.18	0.012
Durationofsensoryblock	732.95 ± 51.51	664.82 ± 59.36	0.0001
Durationofmotorblock	829 ± 45.72	733.82 ± 42.58	0.0001

Dexamethasone gr oup duration of analgesia (956.97 ± 42.57 min vs 821.46 ± 38.91 min), delayed first rescue analgesic requirement (14.57 ± 3.16 hours vs 11.25 ± 2.08 hours) & less doses of rescue analgesia required (1.2 ± 0.56 vs 1.5 ± 0.57) as compared todexmedetomidine group & difference was statistically significant (p< 0.05).

Table3: Duration of analgesia and time for first rescueanalgesia in both groups.

Characteristics	Groupa(Mean ± SD)	Groupb(Mean ± SD)	P Value
Durationofanalgesia(Min)	956.97 ± 42.57	821.46 ± 38.91	0.0001
Timeforfirstrescueanalgesic Requirement (Hours)	14.57 ± 3.16	11.25 ± 2.08	0.0001
Mean Total Doses of Rescue Analgesia Required	1.2 ± 0.56	1.5 ± 0.57	0.0001

Adverseeffects such as nausea, vomiting, sedation, hypotension & bradycardia werenoted in present study. Except sedation, other were comparable among both groups. Sedation wasseen only in dexmedetomidine group.

Table4: Comparison of adverse effects.

Characteristics	Groupa No. Of Patients (%)	Groupb No. Of Patients (%)	P Value
Nausea	3(5.56 %)	1(1.85 %)	0.62
Vomiting	2(3.7 %)	3(5.56 %)	0.84
Sedation	0	6(11.11 %)	-
Hypotension	1(1.85 %)	3(5.56 %)	0.62
Bradycardia	1(1.85 %)	2(3.7 %)	0.87

DISCUSSION

In the present prospective randomized comparative study, the efficacy of dexamethasone and dexmedetomidine as adjuvants to 0.5% ropivacaine in supraclavicular brachial plexus block was evaluated in 108 patients. Both groups were comparable with respect to demographic variables such as age, height, weight, gender distribution, ASA physical status, and duration of surgery, indicating proper randomization and eliminating confounding bias.

The key finding of the present study was that dexamethasone produced a significantly faster onset of both sensory and motor block compared to dexmedetomidine. This observation is consistent with earlier studies suggesting that dexamethasone may enhance local anaesthetic penetration and reduce inflammatory-mediated nociceptive transmission, thereby facilitating quicker onset of action.[9]In contrast, dexmedetomidine, although effective, has been reported to have a comparatively slower onset due to its different mechanism involving hyperpolarization of nerve fibers via α2 receptor-mediated pathways.[10]

The duration of sensory and motor blockade was significantly prolonged in the dexamethasone group. Similarly, total duration of analgesia and time to first rescue analgesic requirement were also significantly higher in the dexamethasone group. These findings are in agreement with multiple clinical studies demonstrating that perineural or systemic dexamethasone significantly prolongs the duration of peripheral nerve blocks, possibly due to its anti-inflammatory effects and inhibition of ectopic neuronal discharge.[11],[12] The longer duration of analgesia observed in this study reduces postoperative analgesic requirements and improves patient comfort.

In contrast, dexmedetomidine is known for its sedative and analgesic-sparing properties. In the present study, sedation was observed exclusively in the dexmedetomidine group, which is consistent with its central sympatholytic action. Although this sedation may be beneficial in reducing perioperative anxiety, it may also delay early neurological assessment in some patients.[13] However, the sedation observed was clinically acceptable and did not require intervention.

Regarding adverse effects, both groups demonstrated comparable safety profiles. Incidences of nausea, vomiting, hypotension, and bradycardia were low and statistically insignificant between the groups. These findings suggest that both adjuvants are relatively safe when used in appropriate doses with ropivacaine in supraclavicular brachial plexus block. Previous literature also supports that both dexamethasone and dexmedetomidine have minimal clinically significant systemic side effects when used in regional anesthesiatechniques.[14]

The superior analgesic profile of dexamethasone observed in this study may be clinically advantageous in day-care and ambulatory surgeries where prolonged postoperative analgesia with minimal sedation is desired. However, dexmedetomidine may still be preferred in selected cases where mild sedation and anxiolysis are beneficial.

Overall, the present study demonstrates that both dexamethasone and dexmedetomidine are effective adjuvants to ropivacaine in supraclavicular brachial plexus block, but dexamethasone provides a more prolonged sensory and motor block along with extended postoperative analgesia.

CONCLUSION

The present study concludes that both dexamethasone and dexmedetomidine are effective adjuvants to 0.5% ropivacaine in supraclavicular brachial plexus block, improving block characteristics and postoperative analgesia. However, dexamethasone provides a significantly faster onset of sensory and motor block, prolonged duration of anaesthesia and analgesia, and delayed requirement of rescue analgesics compared to dexmedetomidine. Dexmedetomidine, on the other hand, is associated with a higher incidence of sedation, which may be beneficial in selected clinical situations but does not translate into superior analgesic duration. Both drugs demonstrated comparable haemodynamic stability and a similar safety profile with minimal adverse effects. Hence, dexamethasone appears to be a more effective adjuvant than dexmedetomidine when combined with ropivacaine for supraclavicular brachial plexus block in upper limb surgeries.

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