Original Research Paper

Volume - 16 | Issue - 04 | April - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

DEXMEDETOMIDINE VS DEXAMETHASONE AS AN ADJUVANT TO 0.5% ROPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES – A PROSPECTIVE COHORT STUDY.

Dr. Nimitha MT Assistant Professor, Department of Anesthesiology

Dr. Jesvin Jois Abraham Senior Resident, Department of Anesthesiology

KEYWORDS :

INTRODUCTION

Brachial plexus block has become a highly effective alternative for general anaesthesia in upper limb surgeries. It minimizes the body's stress and the need for multiple anaesthetic medications. It provides both intraoperative pain relief and postoperative pain management and is acheived by administering a local anaesthetic in combination with adjuvant, aiding both motor and sensory block.

Supraclavicular brachial plexus block eludes the complexities associated with general anaesthetic drugs and the possible complications of upper airway intubation and executes adequate muscle relaxation with stable intraoperative hemodynamics and provides postoperative analgesia.[1]

Ultrasonographic imaging of peripheral nerves, needle placement, and local anaesthetic spread has allowed anaesthesiologists to render analgesic benefits ofregional anaesthesia.[2] Ropivacaine provides more differential blockade and is safe forcardiovascular and central nervous systems. Hence it is preferred over bupivacaine.

Adding adjuvants like dexmedetomidine, dexamethasone, buprenorphine, clonidine, midazolam & magnesium are known to provide added benefits to regional anaesthesia[3] of these, Dexamethasone and Dexmedetomidine are two widely used adjuvant to local anaesthetics, which can effectively prolong postop analgesia and influence sensory and motor block. Both dexamethasone and dexmedetomidine have the ability to diminish local inflammation and enhance the duration of nerve block by inducing vasoconstriction, thereby preserving the local anaesthetic's concentration at the site. Different researches have shown that on adding these additives, anaesthetic and analgesic requirement are reduced substantially along with maintenance of hemodynamic stability. Steroids have potent anti-inflammatory and analgesic properties. Dexamethasone, when combined with local anaesthetics for peripheral nerve blocks, has been shown to enhance postoperative analgesia, with dexamethasone microspheres prolonging the block duration in human studies.[4,5] In addition, it also provides conscious sedation,hemodynamic stableness with less adverse effects.[6]

Objectives

1. To evaluate the efficacy of dexmedetomidine and dexamethasone combined with ropivacaine for supraclavicular approach of brachial plexus block by assessing

(a) The onset and duration of sensory and motor blockade and
(b) Hemodynamic parameters.

METHODOLOGY

Study Type and Population: A prospective cohort study was conducted in patients aged 18–65 years undergoing upper limb surgery in the Department of Anaesthesiology at Pushpagiri Institute of Medical Sciences and Research Centre, Tiruvalla, between November 2022 and March 2024.

Sample Size: Assuming 95% confidence interval and 80% power based on the mean and standard deviation of onset of sensory block each Groups, the sample size was calculated to be 54 in each Group.

$$n = \left(Z_{\alpha} + Z_{1-\beta}\right)^2 \frac{x\left(S_1^2+S_2^2\right)}{(\mu 1-\mu 1)^2}$$

n= sample size per Group
Z_{α} at 95%CI = 1.96 $Z_{1-\beta}$ at 80% power = 0.84

Inclusion Criteria:

1. ASA I & II
2. Age from 18-65 yrs (both males and females)
3. Patients posted for Upper limb surgeries.

Patients with brachial plexus injury, drug hypersensitivity, coagulation disorders, local infection, pregnancy, baseline heart rate <60 bpm, and refusal were excluded.

Study tools: A pre-designed questionnaire was used to record demographic and clinical details. Sensory blockade was assessed using the pin-prick test, while motor blockade was evaluated with the Bromage scale. Pain intensity was measured with the visual analogue scale (VAS). An ultrasound (USG) machine was used to facilitate the procedure.

Study Procedure: A pre-anaesthetic evaluation was performed on the day prior to surgery, and written informed consent was obtained. Nil per oral kept for eight hours before the procedure. They were randomly allocated into two groups. "Group A" received 0.5% ropivacaine (20 ml) with dexmedetomidine (0.5 µg/kg), while "Group B" received 0.5% ropivacaine(20 ml) with dexamethasone (8 mg). Baseline vital parameters were recorded in the operating room. Under strict aseptic conditions, patients were positioned supine and an ultrasound-guided supraclavicular approach of brachial plexus block was administered. Sensory and motor blockade were assessed every five minutes until onset. Heart rate, blood pressure, and oxygen saturation were monitored before the block, every five minutes for the first 30 minutes thereafter, and subsequently at 15-minute intervals until the completion of surgery. Post-operative sensory and motor block characteristics and vital parameters were recorded at 10 and 30 minutes, and at 1,2,4,6, and 12 hours following surgery. Evaluation of sensory block done using the pin-prick test, motor block using the Bromage scale, and post-operative pain was assessed using the visual analogue scale (VAS).

Outcome Measurements:

1. Time of Onset and duration of Sensory and motor Block
2. Heart Rate
3. Systolic and diastolic blood pressure
4. Mean arterial Pressure
5. Oxygen saturation

Statistical Methods: Statistical analysis was performed using SPSS version 20 Categorical variables were expressed as frequency (percentage) and quantitative variables as mean ± SD. Quantitative data were compared using the independent t-test, and categorical data using the chi-square test. A p value <0.05 was considered significant.

RESULTS

The results of the study are presented as a comparison between dexmedetomidine and dexamethasone adjuvants in terms of onset and duration of sensory and motor blockade.

Table 1: Comparison of Onset of Sensory Block

Group	Mean	SD	N	t	p
dexmedetomidine	11.3	1.5	54	18.55	P<0.01
Dexamethasone	16.1	1.2	54		

The mean time of onset of sensory blockade in Group 1 (dexmedetomidine adjuvant) was 11.3 ± 1.5 mins and in Group 2 (dexamethasone

adjuvant) was 16.1 ± 1.2 minutes. The onset of sensory blockade was faster for Group 1 and was statistically significant (t=18.55, p<0.01).

Table 2: Comparison of Onset of Motor Block Based on Group

Group	Mean	SD	N	t	p
dexmedetomidine	15.4	1.6	54	11.29	P<0.01
Dexamethasone	18.8	1.5	54		

The mean time of onset of motor blockade in Group 1 (dexmedetomidine adjuvant) was 15.4± 1.6 mins and in Group 2 (dexamethasone adjuvant) was 18.8 ± 1.5 minutes. The onset of sensory blockade was faster for Group 1 and was statistically significant (t=11.29, p<0.01).

Table 3: Comparison of Duration of Sensory Block Based on Group

Group	Mean	SD	N	t	p
dexmedetomidine	13.3	0.5	53	8.47	P<0.01
Dexamethasone	12.4	0.6	54		

The mean time of duration of sensory blockade in Group 1 (dexmedetomidine adjuvant) was 13.3 ± 0.5 hours and in Group 2 (dexamethasone adjuvant) as 12.4 ± 0.6 hours. The duration of sensory blockade was faster for Group 1 and was statistically significant (t=8.47, p<0.01).

Table 4: Comparison of Duration of Motor Block Based on Group

Group	Mean	SD	N	t	p
dexmedetomidine	12.5	0.6	54	8.51	P<0.01
Dexamethasone	11.5	0.6	54		

The mean time duration of motorblockade in Group 1 (dexmedetomidine adjuvant) was 12.5 ± 0.6 hours and in Group 2 (dexamethasone adjuvant) was 11.5±0.6 hours. The duration of motor blockade was faster for Group 1 and was statistically significant (t=8.51, p<0.01).

DISCUSSION

The present study evaluated and compared 0.5% ropivacaine with dexmedetomidine and dexamethasone as adjuvants in ultrasound-guided supraclavicular approach of brachial plexus block for upper limb surgeries. The principal findings demonstrate that dexmedetomidine produced a significantly quicker onset and prolonged duration of both sensory and motor blockade when compared to dexamethasone, while maintaining satisfactory perioperative hemodynamic stability.

Ultrasound guidance was uniformly employed for all blocks in the present study to enhance accuracy and consistency. The ability to directly visualize neural structures, adjacent vessels, pleura, and real-time spread of local anesthetic improves block success and reduces complications such as vascular puncture and pneumothorax. Previous comparative studies have shown that ultrasound-guided supraclavicular blocks are associated with reduced procedure time, faster onset of blockade, prolonged analgesia, and improved block quality when compared to nerve stimulator-guided techniques[7,8]. The use of ultrasound in the present study therefore minimized technical variability and allowed a reliable comparison between adjuvants.

In the current study, dexmedetomidine significantly reduced the onset time of sensory blockade (11.3 ± 1.5 min) compared to dexamethasone (16.1 ± 1.2 min). Similar findings have been reported by Singh et al. and Patki et al., who observed a faster onset of block when dexmedetomidine was added to ropivacaine in supraclavicular brachial plexus blocks[9,10]. Akshara et al. further demonstrated a dose-dependent enhancement of block characteristics[11]. The faster onset associated with dexmedetomidine is attributed to its α-2 adrenergic agonist activity, which enhances neuronal hyperpolarization, suppresses action potential propagation, and facilitates earlier nerve conduction blockade[12].

Dexamethasone also shortened the onset of sensory blockade compared to ropivacaine alone, as demonstrated in earlier studies[13,16]. This effect is believed to result from its anti-inflammatory properties, reduction of perineural edema, and vasoconstrictive action that limits systemic absorption of the local anesthetic. However, in the present study, the onset-facilitating effect of dexamethasone was less pronounced than that of dexmedetomidine, suggesting a comparatively weaker influence on nerve conduction.

A similar trend was observed for motor block onset, with dexmedetomidine producing a significantly faster onset (15.4 ± 1.6 min) than dexamethasone (18.8 ± 1.5 min). Dexmedetomidine is known to preferentially affect large myelinated fibers, contributing to earlier motor blockade. Although dexamethasone has been reported to hasten motor block onset in some studies, its effect appears less consistent and more dependent on anesthetic volume and concentration[13,17].

The duration of sensory blockade was higher in the dexmedetomidine group (13.3 ± 0.5 h; 798 ± 30 min) compared to the dexamethasone group (12.4 ± 0.6 h; 744 ± 36 min). This finding is consistent with several studies and systematic reviews demonstrating prolonged sensory block with dexmedetomidine as a perineural adjuvant[9,14,15]. The prolongation of sensory blockade is attributed to peripheral vasoconstriction, reduced vascular uptake of local anesthetic, and direct inhibition of C-fiber–mediated nociceptive transmission[12]. Dexamethasone also extended sensory block duration, likely through suppression of inflammatory mediators and stabilization of neuronal membranes, though the effect was comparatively shorter in the present study, possibly due to the lower anesthetic volume used.

Similarly, the duration of motor blockade was significantly longer with dexmedetomidine (12.5 ± 0.6 h; 750 ± 36 min) than with dexamethasone (11.5 ± 0.6 h; 690 ± 36 min). Dexmedetomidine prolongs motor block by enhancing the local anesthetic effect at the nerve fiber level and reducing systemic clearance. Previous studies have reported even longer motor block durations with higher doses or volumes, supporting a dose- and volume-dependent effect[14,15]. Dexamethasone also increased motor block duration, although to a lesser extent when directly compared with dexmedetomidine[16].

Hemodynamic parameters throughout the perioperative period remained stable in both groups. The lower heart rate observed in patients receiving dexmedetomidine is consistent with its central and peripheral sympatholytic effects[12,1]. Importantly, this reduction was not associated with clinically significant hypotension or bradycardia requiring intervention, supporting the safety of dexmedetomidine when used in low doses as a perineural adjuvant[9].

Overall, the findings of the present study are in agreement with previously published comparative studies evaluating dexmedetomidine and dexamethasone as adjuvants to ropivacaine[9,14,1]. While both agents enhance block characteristics and prolong analgesia, dexmedetomidine consistently demonstrates superior efficacy in terms of faster onset and longer duration of sensory and motor blockade. Variations in absolute values across studies may be attributed to differences in local anesthetic volume, adjuvant dose, and patient population.

The strengths of this study include the application of ultrasound guidance, standardized drug protocols, and objective assessment of block characteristics. Limitations include the single-center design and the absence of a ropivacaine-only control group. Postoperative analgesic consumption beyond block duration was not assessed.

CONCLUSION

Our study concludes that using 0.5mcg/kg Dexmedetomidine as an adjuvant is superior to 8mg Dexamethasone in enhancing the onset and duration of sensory and motor blocks of 20ml 0.5% Ropivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Blocks.

REFERENCES

1. Xiong C, Han C peng, Zhao D, Tang Z hao, Zhang Y fan, Wang J. Comparing the effects of dexmedetomidine and dexamethasone as perineural adjuvant on peripheral nerve block: A PRISMA-compliant systematic review and metaanalysis. Medicine (Baltimore). 2021;100(34):e27064. doi:10.1097/ MD.0000000000027064
2. Choi S, McCartney CJL. Evidence Base for the Use of Ultrasound for Upper Extremity Blocks: 2014 Update. Reg Anesth Pain Med. 2016;41(2):242-250. doi:10.1097/AAP.0000000000000155
3. Singh N, Gupta S, Kathuria S. Dexmedetomidine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2020;36(2):238-243. doi:10.4103/joacp.JOACP_176_19
4. Stanley Feldman HE. Anatomy for Anaesthetists. 7th edition.; 1997
5. Mistry T, Mangal V, Sharma G, Agarwal A. Assessment of variation in dept of brachial plexus using ultrasound for supraclavicular brachial plexus block in patients posted elective surgery of upper limb. Indian J Anaesth 2016;60:393- 7.
6. Singh AP, Mahindra M, Gupta R, Bajwa SJ. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. anaesthesia, essays and researches. 2016 Sep;10(3):414.
7. Choi S, McCartney CJL. Evidence base for the use of ultrasound for upper extremity blocks: 2014 update. Reg Anesth Pain Med. 2016;41(2):242-250.
8. Alfred VM, Srinivasan G, Zachariah M. Comparison of ultrasound with peripheral nerve stimulator-guided technique for supraclavicular block in upper limb surgeries. Anesth Essays Res. 2018;12(1):50-54.
9. Singh N, Gupta S, Kathuria S. Dexmedetomidine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2020;36(2):238-243.

10. Patki DY, Bengali DR, Patil DT. Efficacy of dexmedetomidine as an adjuvant to 0.5% ropivacaine in supraclavicular brachial plexus block. Indian J Clin Anaesth. 2013;4(1):35-40.
11. Akshara P, Govindan DK, Govindasamy J, Arif M, Sethuraman RM. Different doses of dexmedetomidine combined with ropivacaine for ultrasound-guided supraclavicular block. Anesth Essays Res. 2022;16(1):94-97.
12. Weerink MAS, Struys MMRF, Hannivoort LN, Barends CRM, Absalom AR, Colin P. Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. Clin Pharmacokinet. 2017;56(8):893-913.
13. Mehta SS, Patel NS. Dexamethasone as an adjuvant to 0.5% ropivacaine for ultrasound-guided supraclavicular brachial plexus block. J Evid Based Med Healthc. 2021;8(14): 849-853.
14. Mokkarala RR, Badugu JP. Evaluation of dexmedetomidine as adjuvant to 0.5% ropivacaine in comparison to dexamethasone in supraclavicular block. Int J Clin Trials. 2022;9(2):89-93.
15. Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Saudi J Anaesth. 2015;9(2):148-154.
16. Venkatraman R, Pushparani A, Karthik K, Nandhini P. Comparison of morphine, dexmedetomidine and dexamethasone as adjuvants to ropivacaine in ultrasound-guided supraclavicular block. J Anaesthesiol Clin Pharmacol. 2021;37(1):102-107.