



A EFFECTIVENESS OF ADJUVANT DEXMEDETOMIDINE AND DEXAMETHASONE TO ROPIVACAINE IN ULTRA SOUND GUIDE SUPRACLAVICULAR BLOCK IN ADULT PATIENT UNDERGOING ELECTIVE UPPER LIMB SURGERIES

Anaesthesiology

Dr. Aftab Hussain Dept. of Anesthesia

Dr. Rangit Priyakar Pandey HOD Dept. of Anesthesia

Dr. Shaeen Begum Dept. of Anesthesia

ABSTRACT

Introduction: This study aimed to compare the clinical efficacy of dexmedetomidine and dexamethasone as adjuvants to ropivacaine in ultrasound-guided supraclavicular brachial plexus block (SCBP). SCBP is a widely used regional anesthesia technique for upper limb surgeries, with ultrasound improving safety and precision. Both adjuvants enhance block characteristics and analgesia duration.

Aim & Objective:

- To compare the onset and duration of sensory and motor block using dexmedetomidine versus dexamethasone as adjuvants to ropivacaine.
- To assess postoperative pain scores using the Visual Analogue Scale (VAS).
- To evaluate postoperative analgesic requirements including time to first rescue analgesia and total analgesic consumption.

Methodology: This prospective, randomized, double-blind study at Rajshree Medical Research Institute enrolled 100 patients undergoing upper limb orthopedic surgeries. Patients were allocated into three groups, and outcomes such as block duration, VAS scores, opioid use, and analgesic consumption were recorded and analyzed. **Results:** The motor block recovery time was significantly prolonged in Group A (401 ± 53.5 min) and Group B (346 ± 61.8 min) compared to Group C (277 ± 47.1 min, $p < 0.001$). Similarly, sensory block duration was longer in Group A (390 ± 58.6 min) and Group B (347 ± 54.9 min) than Group C (272 ± 52.5 min, $p < 0.001$). Time to first analgesic request was longest in Group B (1352.34 ± 154.88 min), followed by Group A (1202.2 ± 143.67 min), and shortest in Group C (1028.0 ± 213.43 min, $p < 0.001$). VAS scores at 6, 12, and 48 hours showed no significant intergroup differences. Total analgesic consumption was least in Group A (19.16 ± 5.61 mg) and highest in Group C (40.17 ± 5.62 mg, $p < 0.001$). Patient satisfaction scores were positively correlated with block duration and negatively with analgesic consumption.

Conclusion: Dexamethasone and dexmedetomidine enhance sensory and motor block duration, prolong postoperative analgesia, and reduce analgesic consumption when added to ropivacaine in SCBP. Dexmedetomidine offers superior analgesia duration, while dexamethasone reduces total analgesic use, improving perioperative pain control and patient satisfaction.

KEYWORDS

INTRODUCTION

The brachial plexus block (BPB) has evolved into a highly effective alternative to general anesthesia for upper limb surgeries, offering reduced physiological stress, lower anesthetic requirements, and fewer systemic side effects [1]. SCBP provides rapid onset, comprehensive upper limb anesthesia, offering excellent intraoperative analgesia and prolonged postoperative relief, called the “spinal of the arm.” [2]. This technique targets the brachial plexus at the level where the trunks and divisions are closely packed, enabling reliable block success [3]. Ultrasound guidance enhances safety and precision in SCBP, improving local anesthetic accuracy and reducing complications, with dexamethasone prolonging block duration. [4,5]. Dexmedetomidine, an α_2 -adrenergic agonist, also improves the quality and duration of analgesia while providing sedative benefits [6].

This study compares dexmedetomidine and dexamethasone as adjuvants to ropivacaine in SCBP blocks, assessing block onset, duration, and complications.

Aims and Objectives

- To compare the onset and duration of sensory and motor block using dexmedetomidine versus dexamethasone as adjuvants to ropivacaine in ultrasound-guided supraclavicular brachial plexus block.
- To evaluate postoperative pain levels using the Visual Analogue Scale (VAS) in both study groups.
- To assess the postoperative analgesic requirements, including the time to first rescue analgesia and total analgesic consumption.

MATERIALS AND METHODS

This prospective randomized double-blind study, conducted at Rajshree Medical Research Institute, Bareilly, included patients aged 20–50 years scheduled for elective upper limb orthopedic surgeries. Excluded were those with infections, coagulation disorders, hypersensitivity to anesthetics, or refusal to participate.

Study materials included 0.5% ropivacaine, 6 mg dexamethasone, 25 mcg dexmedetomidine, 2% lignocaine, normal saline, a 5 cm

Stimuplex needle, 2 ml and 10 ml syringes, and an ultrasound machine with a high-frequency linear probe. Randomization was done using a computer-generated table, and group allocation was concealed using sealed opaque envelopes. Both the patient and the observer collecting postoperative data were blinded to the group assignment.

Preoperatively, all patients were assessed and explained the VAS for pain. In the operating theatre, standard monitors were attached, and a supraclavicular brachial plexus block was administered under ultrasound guidance. Pain scores and rescue analgesic requirements were recorded postoperatively, with intraoperative hemodynamics monitored every 10 minutes.

RESULTS

Table-1 Descriptive Statistics of Motor Block Recovery Time and Sensory Block Recovery Time

Parameter	Group	Mean $\pm$ SD	95% CI (Lower–Upper)	IQR	p-value
Motor Block Recovery Time	Group A (Ropivacaine + Dexamethasone)	401 ± 53.5	383 – 420	97	<0.001
	Group B (Ropivacaine + Dexmedetomidine)	346 ± 61.8	324 – 367	105.5	
	Group C (Ropivacaine Alone)	277 ± 47.1	259 – 294	62.5	
Sensory Block Recovery Time	Group A (Ropivacaine + Dexamethasone)	390 ± 58.6	370 – 410	106	<0.001
	Group B (Ropivacaine + Dexmedetomidine)	347 ± 54.9	328 – 366	88	
	Group C (Ropivacaine Alone)	272 ± 52.5	252 – 292	81.3	

Table-2 Descriptive Statistics of VAS Score at Baseline, 6 hrs, 12 hrs and 48 hr

Time Point	Group	Mean $\pm$ SD	95% CI (Lower–Upper)	IQR	p-value
Baseline	Group A (Ropivacaine + Dexamethasone)	8.06 $\pm$ 1.63	7.50 – 8.62	3	
	Group B (Ropivacaine + Dexmedetomidine)	7.80 $\pm$ 1.47	7.29 – 8.31	2.5	
	Group C (Ropivacaine Alone)	8.17 $\pm$ 1.56	7.59 – 8.75	3	0.616
6 hours	Group A	5.91 $\pm$ 1.67	5.34 – 6.49	2.5	
	Group B	5.77 $\pm$ 1.40	5.29 – 6.25	2	
	Group C	6.30 $\pm$ 1.80	5.63 – 6.97	2.75	0.409
12 hours	Group A	5.09 $\pm$ 2.01	4.40 – 5.77	4	
	Group B	5.11 $\pm$ 1.59	4.57 – 5.66	2.5	
	Group C	5.20 $\pm$ 1.54	4.62 – 5.78	2	0.963
48 hours	Group A	3.97 $\pm$ 1.84	3.34 – 4.60	2.5	
	Group B	3.91 $\pm$ 1.79	3.30 – 4.53	3.5	
	Group C	3.90 $\pm$ 1.71	3.26 – 4.54	2	0.985

Table-3 Descriptive Statistics of Time to First Analgesic Request, Intraoperative Opioids and Total Analgesic Consumption Time to First Analgesic Request, Intraoperative Opioids and Total Analgesic Consumption

Parameter	Group	Mean $\pm$ SD	95% CI (Lower–Upper)	IQR	p-value
Time to First Analgesic Request (min)	Group A (Ropivacaine + Dexamethasone)	1202.2 $\pm$ 143.67	1152.85 – 1251.55	218	
	Group B (Ropivacaine + Dexmedetomidine)	1352.34 $\pm$ 154.88	1299.14 – 1405.54	277.5	
	Group C (Ropivacaine Alone)	1028.0 $\pm$ 213.43	948.30 – 1107.70	367	<0.001
Intra-operative Opioid Use (mg)	Group A	7.17 $\pm$ 1.89	6.52 – 7.82	3	
	Group B	5.89 $\pm$ 2.07	4.78 – 6.99	2.07	
	Group C	6.07 $\pm$ 3.22	5.29 – 6.84	3.22	Not stated
Total Analgesic Consumption (mg)	Group A	19.16 $\pm$ 5.61	17.23 – 21.08	9.05	
	Group B	29.83 $\pm$ 5.42	27.97 – 31.69	8.8	
	Group C	40.17 $\pm$ 5.62	38.07 – 42.27	9.47	<0.001

Table-4 Correlation Matrix (Analgesia Duration, Satisfaction, Consumption)

Para-meters	Operative Time (min)	Pain Onset Time (min)	Total Analgesic Consumption (mg)	Patient Satisfaction Score	Motor Block Recovery Time (min)	Sensory Block Recovery Time (min)
Operative Time (min)	—	r = -0.001, p = 0.993	r = 0.152, p = 0.132	r = -0.253, p = 0.011	r = -0.113, p = 0.265	r = -0.189, p = 0.060
Pain Onset Time (min)		—	r = 0.213, p = 0.033	r = 0.192, p = 0.056	r = 0.245, p = 0.014	r = 0.181, p = 0.072

Total Analgesic Consumption			—	r = -0.535, p < 0.001	r = -0.559, p < 0.001	r = -0.574, p < 0.001
Patient Satisfaction Score				—	r = 0.494, p < 0.001	r = 0.547, p < 0.001
Motor Block Recovery Time					—	r = 0.428, p < 0.001
Sensory Block Recovery Time						—

DISCUSSION

Our study found that Group B (Ropivacaine + Dexmedetomidine) had the longest duration of sensory (347 $\pm$ 54.9 minutes) and motor block (346 $\pm$ 61.8 minutes), significantly longer than Group A (Dexamethasone) and Group C (Ropivacaine alone) (p < 0.001), aligning with Viswambaran et al.^[9] who also observed prolonged block duration with dexmedetomidine as compared to dexamethasone. Singh et al.^[10] reported that both adjuvants enhanced block duration compared to control, with dexmedetomidine yielding marginally superior results in terms of analgesic longevity.

Our result that dexamethasone leads to slightly faster onset of blocks corroborates the findings of Hamada et al.^[11], Dexamethasone offered quicker sensory and motor onset than dexmedetomidine, but dexmedetomidine provided longer analgesia duration. In our study, dexamethasone showed moderate recovery times with less variability.

Our VAS scores across all time points (baseline, 6, 12, 48 hours) did not significantly differ among the three groups (p > 0.4), indicating comparable patient-perceived pain relief. This differs slightly from the report by Margulis et al.^[12], Our study found that Group B (Dexmedetomidine) had the longest time to first analgesic request (1352.34 $\pm$ 154.88 min) and lowest opioid use (5.89 $\pm$ 2.07 mg), matching Nidhi Singh et al.^[13], Our study found that total analgesic consumption was lowest in the dexamethasone group (19.16 $\pm$ 5.61 mg) compared to dexmedetomidine (29.83 $\pm$ 5.42 mg) and control (40.17 $\pm$ 5.62 mg), suggesting an opioid-sparing effect. Prolonged block duration correlated with decreased analgesic consumption and increased patient satisfaction, aligning with Singh et al. (2020).

CONCLUSION

This randomized double-blind study evaluated dexamethasone and dexmedetomidine as adjuvants to ropivacaine in ultrasound-guided supraclavicular brachial plexus blocks. Both adjuvants significantly prolonged sensory and motor block duration. Dexmedetomidine showed the longest analgesic effect and delayed the first analgesic request. Dexamethasone reduced total analgesic consumption. Both adjuvants improved patient satisfaction, with dexmedetomidine offering superior prolongation of analgesia.

REFERENCES

- Bruce BG, Green A, Blaine TA, Wesner LV. Brachial plexus blocks for upper extremity orthopedic surgery. *J Am Acad Orthop Surg*. 2012;20:38–47.
- Choi S, McCartney CJ. Evidence base for the use of ultrasound for upper extremity blocks: 2014 update. *Reg Anesth Pain Med*. 2016;41:242–50.
- Chan VW, Perlas A, Rawson R, Oduko O. Ultrasound guided supraclavicular brachial plexus block. *Anesth Analg*. 2003;97:1514–7.
- Alarasan AK, Agrawal J, Choudhary B, Melhotra A, Uike S, Mukherji A. Effect of dexamethasone in low volume supraclavicular brachial plexus block: A double-blinded randomized clinical study. *J Anaesthesiol Clin Pharmacol*. 2016;32:234–9.
- Pani N, Routray SS, Mishra D, Pradhan BK, Mohapatra BP, Swain D. A clinical comparison between 0.5% levobupivacaine and 0.5% levobupivacaine with dexamethasone 8 mg combination in brachial plexus block by the supraclavicular approach. *Indian J Anaesth*. 2017;61:302–7.
- Ping Y, Ye Q, Wang W, Ye P, You Z. Dexmedetomidine as an adjuvant to local anesthetics in brachial plexus blocks: A meta-analysis of randomized controlled trials. *Medicine (Baltimore)*. 2017;96:e5846.
- Verma NK, Ranjan A. A clinical comparison of dexmedetomidine and dexamethasone as adjuvant to ropivacaine in supraclavicular brachial plexus blocks for upper arm surgeries. *Int J Adv Res Biol Sci*. 2016;3:56–61.
- Chaithanya K, Reddy N. A comparative study between 0.375% ropivacaine with 50 mcg of dexmedetomidine and 0.375% ropivacaine with 8 mg of dexamethasone for ultrasound guided supraclavicular brachial plexus block. *Indian J Clin Anaesth*. 2017;4:69–73.
- Viswambaran H, Singh R, Gupta M, Kumar A, Roy S. Comparative study of dexmedetomidine and dexamethasone as adjuncts to ropivacaine in ultrasound-guided brachial plexus block. *Indian J Anaesth*. 2020;64(8):605–10.

10. Singh D, Sharma V, Singh R, Narang A, Rath V. Efficacy of ropivacaine combined with dexmedetomidine against ropivacaine combined with dexamethasone in supraclavicular brachial plexus blocks. *J Clin Anesth*. 2020;66:109882.
11. Hamada M, Elmahdy I, Ashiry M. Comparing efficacy of bupivacaine plus dexamethasone versus bupivacaine plus dexmedetomidine in ultrasound-guided supraclavicular block for upper limb surgeries. *Acta Anaesthesiol Scand*. 2019;63(5):662-9.
12. Margulis G, Sidi A, Shaked Y, Cohen A, Mosheiff R. Comparison of dexmedetomidine and dexamethasone as adjuvants in interscalene blocks for shoulder arthroscopic surgery. *BMC Anesthesiol*. 2021;21(1):51.
13. Singh N, Kaur R, Gupta A, Maan T, Singh P. Effect of dexmedetomidine and dexamethasone as adjuvants to ropivacaine in supraclavicular brachial plexus block: a comparative study. *Anesth Essays Res*. 2017;11(2):314-9