BJHS
Birat Journal of Health Sciences

ISSN:

2542-2758 (Print) 2542-2804 (Online)

ARTICAE INFO:

Received Date: 26 August, 2024
Accepted Date: 17 March, 2025
Published Date: 30 April, 2025

KEYWORDS:

Brachial plexus block; bupivacaine; dexmedetomidine.

CORRESPONDING AUTHOR:

Dr Rajiv Yadav
Lecturer, Department of Anesthesia
Nepal medical college, Attarkhel, Kathmandu, Nepal
Email: munnaraj2042@gmail.com
Orcid ID: 0009-0001-1712-6318

Access the article online

DOI: 10.62065/bjhs595

CITATION:

Yadav R, Yadav I, Bhandari S, Poudel A. Effect of Dexmedetomidine as an Adjuvant to Ropivacaine in Brachial Plexus Block. 2025; 9 (2): 31-35.

Effect of Dexmedetomidine as an Adjuvant to Ropivacaine in Brachial Plexus Block

Rajiv Yadav[1*], Ila Yadav[2], Sabin Bhandari[1], Anju Poudel[1]

[1*] Department of Anesthesia, Nepal medical college, Attarkhel, Kathmandu, Nepal
[2] Department of Environmental Science, Tribhuvan university, Nepal.

ABSTRACT

Introduction: The purpose of this study was to determine whether dexmedetomidine as an adjuvant to ropivacaine in brachial plexus improves the quality of block in terms of onset, duration of analgesia and assess complications of dexmedetomidine.

Objectives: To evaluate the effect of dexmedetomidine as an adjuvant to ropivacaine for brachial plexus block in upper limb surgery To assess onset of sensory and motor blockade, duration of sensory and motor blockade, duration of analgesia and any adverse effects of dexmedetomidine.

Methodology: 80 patients of American Society of Anesthesiologists (ASA) physical status I and II undergoing upper limb surgery under brachial plexus block were randomly divided into two groups. Group R received 0.35% ropivacaine, 1.5% xylocaine with adrenaline (30ml) and Group RD received 0.35% ropivacaine, 1.5% xylocaine with adrenaline and dexmedetomidine (30ml).

Results: The onset of both sensory and motor block was earlier in Group RD than Group R. They were clinically significant (p value 0.000 for sensory, p value 0.005 for motor). The duration of both sensory and motor block was longer in Group RD than Group R which was statistically significant (p value 0.000 for duration of sensory block, p value 0.000 for duration of motor block). Duration of analgesia was also longer in dexmeditomidine group (p value 0.000).

Conclusions: Dexmedetomidine (1mcg/kg) as adjuvant to ropivacaine in brachial plexus block shortens the onset of (sensory and motor) block, prolongs the duration of (sensory and motor) block and duration of analgesia.

INTRODUCTION

Regional anesthesia as an anesthetic technique plays a vital role for the management of pain in various surgeries due to its versatility, effectiveness in terms of cost, margin of safety, and good postoperative analgesia.

Brachial plexus block is a popular and widely employed regional anesthesia of the upper limb. Various approaches to brachial plexus block for upper limb surgery have been described including supraclavicular, infraclavicular, axillary approach. It not only provides intra-operative anesthesia, but also extends analgesia in the post-operative period without major systemic side-effects by minimizing stress response and using minimal anesthetic drugs.[1]

Ropivacaine is an amino-amide local anesthetic with less cardiac and central nervous system toxicity than other long acting local anesthetics like bupivacaine.[2] Local anesthetics alone for brachial plexus block provide good operative conditions, but have a shorter duration of postoperative analgesia. Hence, various adjuvants such as opioids,[3] ketamine, neostigmine, dexamethasone,[4]adrenaline admixtures for Brachial plexus block in providing perioperative analgesia. Hence,

various adjuvants such as opioids, [3] ketamine, neostigmine, dexamethasone, [4] tramadol, clonidine, [5] are used with local anesthetic agents to prolong the duration of peripheral nerve blocks and decrease the time of onset. However, the results are either inconclusive or associated with side-effects.

Dexmeditomidine is new α2-adrenergic agonist drug. It is eight times more selective to α2-receptor than clonidine. It provides anxiolysis and sedation without respiratory depression, and has organ-protective effects against ischemic and hypoxic injury, including cardioprotection, neuroprotection, and renoprotection.[6] It has been reported to improve the quality of intrathecal and epidural anesthesia when used along with LA as adjuvant.[7] In this study, we assessed the effect of dexmedetomidine as an adjuvant to Ropivacaine in brachial plexus block in terms of duration of postoperative analgesia and complications, if any.

METHODOLOGY

Type of study: This is hospital based randomized control trial

Place of study:

The study was conducted in Nepal Medical College and Teaching Hospital (NMCTH), Kathmandu.

Duration of study:

It was from February 2023 to May 2024

Study Group:

All patients undergoing upper limb surgery under Supraclavicular, Infraclavicular, Axillary, Interscalene brachial plexus block, who fulfilled inclusion criteria were enrolled for the study.

Sample Size:

Target sample was obtained by the formula

$$\text{Number of cases (n)} = \frac{Z^2 \times \sigma^2}{d^2}$$

Z= 1.96 keeping the type I error of 5% and confidence interval of 95%

σ = SD of duration of analgesia from reference study

d = (desirable error) i.e 5% of mean of duration of analgesia

Mean of duration of analgesia from reference study = 967.55 min[16]

d = 10% of mean of duration of analgesia= 96.7

σ from reference study = 310.50 min[16]

$$\text{Number of cases (n)} = \frac{1.96^2 \times 310.50^2}{96.7^2}$$

$$= 39.55$$

Hence the sample size to be taken was 40 in each group.

Inclusion Criteria

ASA physical status I and II patients, age 20-60years, weight 45 to 75 kg, elective upper limb surgery under brachial plexus block.

Exclusion Criteria

Known hypersensitivity or contraindication to ropivacaine and dexmeditomidine, pregnant or lactating mothers, hepatic, renal or cardiopulmonary abnormality, long term analgesic therapy, local skin site infections, patient refusal.

Participant Recruitment

After the IRC approval, the patients who meet the inclusion criteria underwent preanesthetic assessment a day prior to the surgery. Anesthetic procedure and VAS (visual Analogue scale) were explained to the patient. Informed consent were obtained. Patients were kept Nil per Os (NPO) as per the ASA fasting guidelines.

In operating room heart rate, blood pressure, peripheral oxygen saturation were recorded. Randomization was done by computer-generated randomized number table. Random number was enclosed in a sealed opaque envelope and was opened by one of the investigators to know the study drug/ combination to be administered just before the block. Observer anesthesiologist was blind to the test drug/combination. Group R received 0.35% ropivacaine 20ml with 1.5% xylocaine with adrenaline 10ml (total 30ml) and Group RD patient received 0.35% ropivacaine 20ml and 1.5% xylocaine with adrenaline, dexmeditomidine (1 mcg/kg) 10ml (total 30ml). An 18 gauge intravenous (i.v) cannula was inserted and Ringer lactate (RL) infusion was started at 10ml/kg/hr. Brachial plexus block was performed by ultrasound (USG) Guided single-injection and nerve stimulator technique by principal investigator involved in the study. Brachial plexus was located and the drug was injected as per the need of surgery. After the whole drug has been injected the time was noted as the time of block administration. Both sensory and motor blocks were assessed every 3 min till their onset and at 15, 30, 45, 60, 90, 120min and then hourly till the effect of block completely resolves (Figure 1).

Sensory block assessed by 3–point scale

0 – normal sensation

1 – loss of sensation of pinprick

2 – loss of sensation of touch

Duration of sensory block, defined as time interval between complete sensory block and complete resolution of anesthesia (score 0).

Motor blockade assessed by modified Bromage scale (MBS)

0-able to raise extended arm to 90 degree for full two seconds

1-able to flex elbow, move fingers but unable to raise extended arm

2-unable to flex elbow but able to move fingers

3-unable to move arm, elbow, fingers

Duration of motor block defined as time interval from complete

motor block to recovery of complete motor function (MBS 0).

Surgery was allowed once sensory and motor block were achieved. Patient who complained of pain intraoperatively, analgesics was given and they were excluded from the study. Inadequate sensory, motor blockade >30 min after infiltration was considered unsuccessful block, GA was given and patients were excluded. Hypotension, bradycardia, sedation and other complications like nausea, vomiting, Horner's syndrome, pneumothorax and signs of LA toxicity was looked and managed, if any.

In the Postoperative ward patients were assessed hourly for pain, recovery of sensory, motor block till 24 hours by observer anesthesiologist who was blinded to study drug/combination. Pain was assessed with VAS. If VAS >3, inj. ketorolac 30mg i.v was given and the time and number of dose were noted. Patients were asked to note subjective recovery of sensation, movements that was certified by the investigator. Time between complete sensory block to 1st analgesic request was defined as duration of analgesia. Total amount of ketorolac consumption in 1st 24hrs was also recorded.

Statistical Analysis

Data analysis was performed by using SPSS version 16. Mean ± standard deviation (SD) was calculated for age. For demographic and hemodynamic variables like age, weight, heart rate, blood pressure, and mean arterial, the student's t-test was applied. To see the association between the groups for categorical variables like gender, ASA physical status, VAS, and adverse effects, the Chi-square test was used. Mann Whitney U test was applied for the onset of sensory block, the onset of motor block, and duration of analgesia. A p-value <0.05 was considered as statistically significant.

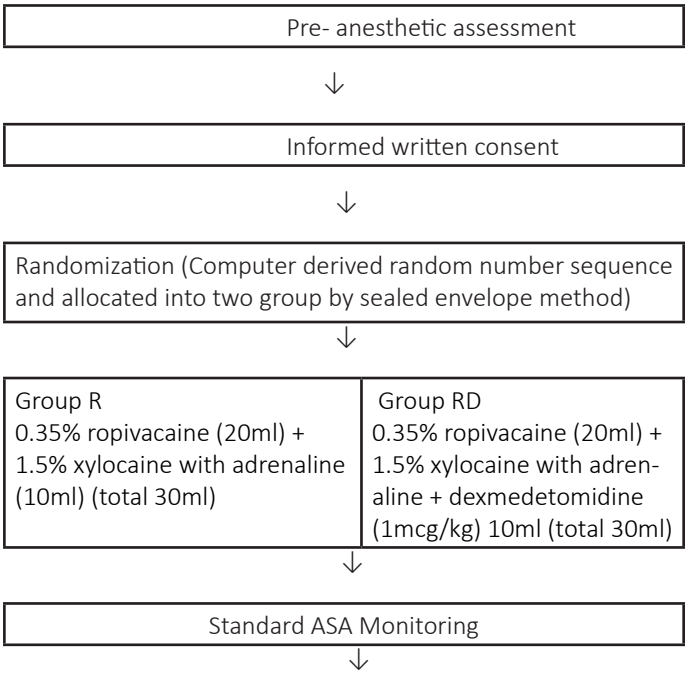

Figure 1. Graphic representation of study design and procedure

RESULTS

Total 80 patients were recruited in the study. Of the total 5 patients were excluded from the study due to block failure and complications intraoperatively. Demographic data (age, weight, gender) and ASA Physical Status (PS) of patients were comparable in both the groups (Table 1). The onset of both sensory and motor block was earlier in Group RD than Group R, and they were clinically significant (Table 2). The duration of sensory and motor block was longer in Group RD than Group R, which was statistically significant (P value 0.00). Duration of analgesia was also longer in dexmeditomidine group (Table 3).

20 patients in Group RD were sedated with RAAS 0,-1. Bradycardia were observed in 2 patients belonging to group RD intraoperatively and corrected without injection atropine. Hypotension were observed in 5 patients belonging to group RD, which was effectively treated with intravenous fluid. None of these side effects were observed in Group R.

Table 1: Patient characteristics

Parameter	Group R	Group RD	P value
Age(years) (Mean±SD)	36±15.86	31.3±12.04	0.556
Gender (Male/Female)	25:10	31:9	0.546
ASA physical status (I/II)	16/19	18/22	1.0
Body weight(kg) (Mean±SD)	60±7.35	62±10.42	0.28

Table 2: Onset of sensory and motor blockade

Onset of block	Group R	Group RD	P value
Sensory(min) (Mean±SD)	5.94 ±1.97	3.98 ±1.64	0.000
Motor(min) (Mean±SD)	9.46±2.69	7.5±3.11	0.005

Table 3: Duration of blockade and analgesia

Duration of block	Group R	Group RD	P value
Sensory(min) (Mean±SD)	308.31±47.90	467.83±106.04	0.000
Motor(min) (Mean±SD)	280.74±48.54	414.83±102.66	0.000
Duration of analgesia(min) (Mean±SD)	310.14±50.80	481.18±126.82	0.000

Table 4: Total analgesic in 24hr

Dose of ketorolac (30mg)	Group R	Group RD
Single	0	20
Two	8	11
Three	27	9

DISCUSSION

In this study we determined the effect of dexmedetomidine 1mcg/kg as an adjuvant to ropivacaine in ultrasound guided brachial plexus block in terms of onset, duration of sensory and motor blocks and also total duration of analgesia.

Dexmedetomidine is a highly specific and selective α2 adrenoceptor agonist. Peripherally, α2 agonists produce analgesia by reducing release of norepinephrine and causing α2 receptor-independent inhibitory effects on nerve fiber action potentials. Centrally, α2 agonists produce analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α2 adrenoceptors in the locus coeruleus. Other possible mechanism by which the α2 agonists improve local anesthetic action include vasoconstriction around the site of injection, thus delaying the absorption of local anesthetic drug, resulting in a prolongation of the local anesthetic effect.

In our study, we have found that addition of dexmedetomidine (1µg/kg) to 20 ml ropivacaine 0.35% in ultrasound-guided supraclavicular brachial plexus block resulted in a quick onset of sensory and motor block, prolonged duration of both sensory and motor block , prolonged duration of analgesia when compared with control group. The results of our study are similar to the study done by Singh AP et al.[15] They studied the effect of adding dexmedetomidine (100mcg) to 0.5% bupivacaine and found that dexmedetomidine as an adjuvant to bupivacaine significantly shortened onset of sensory and motor block, prolonged duration of both sensory and motor block, prolonged duration of analgesia. Kathuria S et al[17] added 50mcg of dexmedetomidine to 20ml of 0.5% ropivacaine. They found that dexmedetomidine as an adjuvant to 0.5% ropivacaine shortens the sensory as well as motor block onset time, prolongs sensory and motor block duration and also increases the duration of analgesia. Esmaoglu A et al[13] studied the effect of adding 100mcg of dexmedetomidine to 40ml of 0.5% levobupivacaine and their results were similar to our study.

In our study, 20 patients in dexmedetomidine were sedated with RAAS 0,-1. However, clinically none required any intervention for sedation. In the study done by Dharmarao PS et al[16] Sedation was seen in only 6 patients in the dexmedetomidine group which is less than our study. This difference is due to precise use of sedation score in our study. Bradycardia were observed in 2 patients and hypotension in 5 patients belonging to dexmedetomidine group intraoperatively and corrected without use of drugs which, was less than study done by Esmaoglu A et al.[13] In their study, bradycardia was observed in 7 patients in dexmedetomidine group, and all of these patients were treated with atropine. Less number of bradycardia and hypotesion in our study is due to lower dose of dexmedetomidine (1mcg/kg).

CONCLUSION

Based on this study, we conclude that dexmedetomidine (1mcg/kg) as adjuvant to ropivacaine in brachial plexus block shortens the onset of (sensory and motor) block, prolongs the duration of (sensory and motor) block, as well as prolongs the duration of analgesia.

LIMITATIONS OF THE STUDY

Small sample size

ACKNOWLEDGEMENT

I would like to extend my deep sense of gratitude to all the faculty members and residents of Department of Anesthesiology, Nepal Medical College, Attarkhel, Jorpati, kathmandu for their support. I am most grateful to my parents Mr. Ram Udar Yadav and Mrs. Sudama Yadav, and my loving wife Mrs. Ila Yadav who inspired me, poured love and time for the completion of this research work.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES

1. Bruce BG, Green A, Blaine TA, Wesner L V. Brachial Plexus Blocks for Upper Extremity Orthopaedic Surgery. Am Acad Orthop Surg. 2012 Jan;20(1):38-47.
DOI: 10.5435/JAAOS-20-01-038
PMID: 22207517

2. Vainionpaa VA, Haavisto ET, Huha TM, Korpi KJ, Nuutinen LS, Hollmen AI, et al. A Clinical and Pharmacokinetic Comparison of Ropivacaine and Bupivacaine in Axillary Plexus Block. Anesth Analg. 1995 Sep;81(3):534-8.
DOI: 10.1097/00000539-199509000-00019
PMID: 7653818

3. Bazin J, Massoni C, Groslier D, Fenies V, Bittar M, Schoeffler P. Brachial plexus block: effect of the addition of sufentanil to local anesthetic mixture on postoperative analgesia duration. Ann Fr Anesth Reanim. 1997 Jan;16(1):9-13.
DOI: 10.1016/S0750-7658(97)84271-2
PMID: 9686089

4. Yadav R, Sah B, Kumar P, Singh S. Effectiveness of addition of neostigmine or dexamethasone to local anaesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. Kathmandu Univ Med J. 1970 Jan 1;6(3):302-9.
DOI: 10.3126/kumj.v6i3.1704
PMID: 20071811

5. Duma A, Urbanek B, Sitzwohl C, Kreiger A, Zimpfer M, Kapral S. Clonidine as an adjuvant to local anaesthetic axillary brachial plexus block: a randomized, controlled study. Br J Anaesth. 2005 Jan;94(1):112-6.
DOI: 10.1093/bja/aei009
PMID: 15516351

6. Gerlach AT, Dasta JF. Dexmedetomidine: An Updated Review.

Ann Pharmacother. 2007 Feb 4;41(2):245-54.
DOI: 10.1345/aph.1H314
PMID: 17299013

7. Congedo E, Sgreccia M, De Cosmo G. New Drugs for Epidural Analgesia. Curr Drug Targets. 2009 Aug 1;10(8):696-706.
DOI: 10.2174/138945009788982441
PMID: 19702518

8. Kaur H, Singh G, Rani S, Gupta K, Kumar M, Rajpal A, et al. Effect of dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double-blind prospective study. J Anaesthesiol Clin Pharmacol [Internet]. 2015;31(3):333-338.
DOI: 10.4103/0970-9185.161668
PMID: 26330711 PMCID: PMC4541179

9. Sane S, Shokouhi S, Golabi P, Rezaeian M, Kazemi Haki B. The Effect of Dexmedetomidine in Combination with Bupivacaine on Sensory and Motor Block Time and Pain Score in Supraclavicular Block. Pain Res Manag. 2021 Apr 10;2021:8858312.
DOI: 10.1155/2021/8858312
PMID: 33927790 PMCID: PMC8053064

10. Modh DB, Parmar M, Solanki S. Effect of dexmedetomidine as adjuvant in supraclavicular block for upper limb orthopedic surgeries. Int Surg J. 2017 Apr 22;4(5):1510.
DOI: 10.18203/2349-2902.isj20171589

11. Lalwani J BRANSP. Dexmedetomidine with 0.375% bupivacaine for prolongation of postoperative analgesia in supraclavicular brachial plexus block. Indian Journal of Pain (Jan 2019);33(1):31-34.
DOI: 10.4103/ijpn.ijpn_9_19

12. Mahmoud K, Ammar A. Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. Saudi J Anaesth. 2012;6(2):109.
DOI: 10.4103/1658-354X.97021
PMID: 22754434 PMCID: PMC3385250

13. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine Added to Levobupivacaine Prolongs Axillary Brachial Plexus Block. Anesth Analg. 2010 Dec;111(6):1548-51.
DOI: 10.1213/ANE.0b013e3181fa3095
PMID: 20889939

14. Shrestha A, Shrestha A, Shrestha A, Piya R, Pradhan M, Amatya SP, et al. Dexmedetomidine as an adjunct to bupivacaine and xylocaine with adrenaline in ultrasound guided supraclavicular brachial plexus block in upper limb surgeries. J Patan Acad Heal Sci. 2022 Jan 7;9(1):25-31.
DOI: 10.3126/jpahs.v9i1.31127

15. Singh A, Mahindra M, Gupta R, Bajwa SS. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. Anesth Essays Res. 2016;10(3):414.
DOI: 10.4103/0259-1162.176404
PMID: 27746525 PMCID: PMC5062198

16. Dharmarao PS et al. Comparative Study of the Efficacy of Dexmedetomidine and Fentanyl as Adjuvants to Ropivacaine in Ultrasound-Guided Supraclavicular Brachial Plexus Block. Turkish J Anesth Reanim. 2018 Jul 9;208-13.
DOI: 10.5152/TJAR.2018.98058
PMID: 30140517 PMCID: PMC6097859

17. Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Saudi J Anaesth. 2015;9(2):148.
DOI: 10.4103/1658-354X.152841
PMID: 25829902 PMCID: PMC4374219