ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 05 | May - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE STUDY OF VARYING DOSES OF DEXMEDETOMIDINE AS AN ADJUVANT TO ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK - A RANDOMISED DOUBLE BLIND STUDY

Anaesthesiology

Dr Amar AB 3rd Year Post Graduate Resident Anesthesia, Govt. Medical College, Kota

Dr Shilpi Jain* Assistant Professor, Anesthesia, Govt. Medical College, Kota *Corresponding Author

Dr Mukesh Somvanshi Senior Professor Anesthesia, Govt. Medical College, Kota

Dr Archana Tripathi Senior Professor Anesthesia, Govt. Medical College, Kota

ABSTRACT

Introduction- Supraclavicular brachial plexus block is a very popular technique of anaesthesia for upper limb surgeries. We undertook this study to compare a dose of 50 mcg and 75 mcg of dexmedetomidine as an adjuvant to 0.5% ropivacaine in supraclavicular brachial plexus block in terms of efficacy, duration of postoperative analgesia and side effects. **Methods -** Sixty patients scheduled for upper limb orthopaedic surgeries were randomly allocated into two groups. Group–I received 30ml of 0.5% ropivacaine with 50mcg of dexmedetomidine. Group-II received 30ml of 0.5% ropivacaine with 75mcg of dexmedetomidine. The data was analysed by SPSS (Statistical package for social sciences) software. Students 't' test & Chi-square test were applied. A p value <0.05 were considered as significant. **Result-** Duration of sensory block in group-I was (8.6±0.93 hours) and (10.53±1.33) hours in group-II (p <0.001). Duration of motor block increased by addition of 75mcg dexmedetomidine (10.56±1.13 hours) than with 50mcg dexmedetomidine (7.06±0.86 hours) (p<0.001). There was significant increase in duration of analgesia in group-II (12.63±1.033 hours) compared to group-I (9.73±0.94 hours) (p<0.001). The number of analgesic doses required in postoperative period was significantly less with 75mcg of dexmedetomidine group. Both groups were comparable with regard to adverse effects like sedation, bradycardia and hypotension. **Conclusion -** 75mcg dexmedetomidine shown to have an upper edge over 50mcg dexmedetomidine when used as an adjuvant to 0.5% ropivacaine for brachial plexus block.

KEYWORDS

Supraclavicular brachial plexus block, Ropivacaine 0.5%, Dexmedetomidine, Duration of analgesia.

INTRODUCTION

Supraclavicular brachial plexus block is a very popular technique of anaesthesia for upper limb surgeries. This approach is attractive due to effectiveness in terms of its cost and performance[1,2]. It gives most effective block for all portions of upper extremity and is carried out at the level of trunks of brachial plexus[3]. Ropivacaine is a potent blocker of A δ and C fibres rendering good sensory effect but less motor blockade, long-acting amide local anaesthetic with a potentially improved safety profile when compared to bupivacaine[4,5]. Dexmedetomidine is the d-enantiomer of medetomidine,was introduced in clinical practice in the United States in 1999 and approved at the end of the year for human use for short term sedation and analgesia (<24 hours) for mechanically ventilated adult ICU patients[6,7,8,9]

Dexmedetomidine is a potent centrally acting α-2 agonist widely used for anaesthesia, analgesia, monitored anaesthetic care, and as an adjuvant to local anaesthesia as it prolongs duration of the block and postoperative analgesia[10].

On literature search, dexmedetomidine has been used in 50 mcg and 100 mcg dose with bupivacaine in supraclavicular brachial plexus block[11] & was observed that dexmedetomidine 100 mcg in comparison to 50 mcg has faster and prolonged duration of action but has more incidence of bradycardia and sedation.

We undertook a study to compare a dose of 50 mcg and 75 mcg of dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block in terms of efficacy, duration of complete block, bradycardia & sedation[12,13].

METHODS

This prospective, randomized double blind study was carried out in sixty patients in a tertiary care hospital, after obtaining institutional ethical committee approval & written informed consent from the patients. Patients of age 20-50 years, weight 30-60 kgs, upper limb surgeries of mid arm & fore arm and ASA I and II were included in the study. Patients allergic to drugs, cervical spine abnormalities, reactive airway disease, neuromuscular disorder, haemodynamically unstable patients, class III & IV of Mallampati classification, morbid obesity (BMI >35), inadequate effect requiring supplementation, previous nerve injury, pregnancy, antenatal & lactating females, emergency surgeries, hepatic and renal failure patients were excluded from the study.

Closed opaque-sealed envelope, which were numbered sequentially were used for allocation concealment. The patients were randomised into 2 groups using computer generated randomisation list to receive either of the two regimen.

Group I- Patients were administered 30 ml of 0.5% ropivacaine with 1ml of 50mcg of dexmedetomidine.

Group II - Patients were administered 30 ml of 0.5% ropivacaine with 1ml of 75mcg of dexmedetomidine.

After arrival in operating room, standard anesthetic technique was followed & standard ASA monitors was attached to the patient including three leads ECG, noninvasive blood pressure, pulse oximetry and basal parameters were noted. Intravenous access was secured with 18 gauge cannula and infusion of ringer lactate was started. Patients were explained with the 10 point visual analogue scale (VAS) where 0- No pain and 10- worst pain, before surgery and were asked to grade their pain on this scale.

Patients were placed in supine position and wedge was placed in between the scapulae, with the head turned to the opposite side. The arm on the operative side was adducted and internally rotated, the shoulder was down and the hand is extended along the ipsilateral side. The supraclavicular brachial plexus block was performed under all aseptic precautions. Landmark for supraclavicular approach is 2 cm above to the midpoint of clavicle in the interscalene groove. Lateral to the clavicular head of sternocleidomastoid (palpation of subclavian artery confirms the accuracy of position). A small skin wheal of local anaesthesia was raised at this level and the needle was directed caudal, slightly medial and posterior to elicit paraesthesia or motor response. Then local anaesthetic solution was slowly injected with frequent aspiration.

Intraoperatively, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate, oxygen saturation (SpO_2) were recorded every 10 minutes until the end of surgery and every 30 minutes in the first three postoperative hour followed by every hour for next 12 hours. Hypotension, defined as fall of MAP by >20% from baseline or fall of SBP below 90 mmHg and was given i.v.mephentermine 6mg and IV fluid as required. Bradycardia, defined as HR <50 bpm and was treated with injection atropine 0.6mg intravenously.

Assessment of sensory block was done by pinprick method at each

minute using 26 G needle after completion of drug injection in the dermatome areas. Sensory blockade was graded with Hollmen's scale (H.Sc). 0-Normal sensation of pin prick,1(+)- Pin prick felt as sharp pointed but weaker compared with the same area in other extremity,2(++)- Pin prick felt as touch with blunt object (analgesia),3(+++)- No perception of pin prick (anaesthesia).

Onset of sensory block was considered when pin prick was felt as touch with blunt object (analgesia) in the distribution of blocked nerves. Complete sensory block was considered when there was complete loss of sensation to pin prick along all nerves distribution. The duration of sensory block defined as the time interval between the end of local anaesthetic administration and the complete resolution of anaesthesia in distribution of nerves.

Assessment of motor block was carried out by the observer at every minute interval following drug injection upto 30 minute. Motor block was determined according to Modified Bromage scale (Table-1) for upper extremeties.

Table -1: Modified Bromage Scale

Grade	Criteria	Degree of Block
0	Able to raise the extended arm to 900 for full 2 seconds	Nil (0%)
I	Able to flex the elbow and move the fingers but unable to raise the extended arm	Partial (33%)
II	Unable to flex the elbow but able to move the fingers	Almost complete (66%)
III	Unable to move the arm, elbow, or fingers	Complete (100%)

Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Motor block was determined according to a Modified Bromage scale for upper extremities. Onset of blockade was considered when there was bromage score II. The duration of motor block defined as the time interval between the end of local anaesthetic administration and the recovery of complete motor function of the hand and forearm (Bromage score 0)

All patients were observed in postoperative ward. Intensity of pain was measured using 10 point visual analogue scale (VAS) where 0= no pain and 10= worst possible pain. Duration of analgesia was taken as the time from onset of analgesia upto time when VAS reached 4. Patient were then given rescue analgesic (IM Diclofenac 1-1.5mg/kg), when VAS reached 4 or more. The time of first analgesic use and total need for analgesics were recorded during the first postoperative 24 hours. Post operative follow up was carried out for every hour for first 12 hours and then 2 hourly till 24 hours.

The sedation was assessed intraoperatively and postoperatively at regular interval along with haemodynamics by a Modified Ramsay Sedation scale 1 to 6 as follows: 1= Awake, Anxious, agitated, restless; 2= Awake, Cooperative, oriented, tranquil; 3= Awake, Responds to commands only; 4= Asleep, Brisk response to light glabellar tap or loud noise; 5= Asleep, Sluggish response to light glabellar tap or loud noise; 6= No response

All patients were observed postoperatively for any complaint of pruritis, nausea, vomiting, hypotension, bradycardia, sedation. Intraoperative and postoperative complications were noted and managed accordingly.

Statistical Analysis

The data was analysed by SPSS (Statistical package for social sciences) software. Students 't' test & Chi-square test were applied. A p value <0.05 were considered as significant.

RESULTS

Thirty patients in each group were enrolled for the study. Both the groups were comparable with respect to age, height, weight & sex ratio [table 2].

Table No. 2 Demographic Details

VARIABLE	GROUP I	GROUP II	P value
AGE	34.73±8.5	38.5±8.29	>0.05
HEIGHT	164.36±9.73	163.66±10.84	>0.05
WEIGHT	56.33±4.58	57.66±3.87	>0.05
GENDER(M/F)	19 & 11	22 & 08	>0.05

There was no statistical significance in baseline hemodynamic parameters in both the groups(p>0.05).

The onset of sensory & motor block was also statistically insignificant [table 3].

Table No. 3 Characteristics Of Block

PARAMETER	GROUP I	GROUP II	p-value
Onset of sensory block(min)	12.43±1.3	11.43±1.04	>0.05
onset of motor block(min)	14.06±1.14	12.63±0.99	>0.05
Duration of Sensory block(hrs)	8.6±0.93	10.53±1.33	<0.001
Duration of Motor block(hrs)	7.06±0.86	10.56±1.13	<0.001
Duration of analgesia(hrs)	9.73±0.94	12.63±1.033	<0.001

Similarly, side effects like sedation, bradycardia & hypotension were also not significant [table 4].

Table No. 4 Side Effects

SIDE EFFECT	GROUP I	GROUP II
SEDATION SCORE(>3)	1	2
BRADYCARDIA(HR <50 bpm)	2	3
HYPOTENSION(MAP <60 mmHg)	1	2

The study showed that Dexmedetomidine when added in the dose of 75 mcg had statistically significant difference in duration of sensory & motor block. The duration of sensory block was prolonged in group II (10.53±1.33 hrs) when compared to Group I (8.6±0.93hrs) & the difference was statistically significant (p<0.001) [table3]. The duration of motor block was also prolonged in Group II (10.56±1.13hrs) as compared to Group I (7.06±0.86hr) & the difference was highly significant (p<0.001) [table 3]. Mean duration of analgesia was (12.63± 1.033hr) in group II which was more than mean duration of analgesia in group I (9.73± 0.94hr) and the difference was statistically significant (p< 0.001) [table 3]. The mean number of analgesic dose required in first 24 hours postoperatively in group-I was (2.16± 0.53) and (1.53± 0.5) in group-II. This requirement was comparatively lesser in group-II and the difference was statistically highly significant (P<0.0001) [table5].

Table No. 5 Analgesic Doses In First 24 Hours

Variable	GROUP I	GROUP II	p-Value
No. of Analgesic doses in 24 Hrs	2.16	1.53	0.0001

DISCUSSION

In this randomized, double-blind study, we compared a concentration of 50 mcg and 75 mcg of dexmedetomidine as an adjuvant to 0.5% ropivacaine in supraclavicular brachial plexus block in term of onset of motor and sensory block, duration of motor block & sensory block and analgesia.

Our study showed that onset of sensory block was faster in group-II than in group-I, which was (12.43±1.3 min) in group-I while (11.43±1.04 min) in group-II. But the difference was not statistically significant (p>0.99). The results coincide with the studies done by Nallam SR et al (2017)[14] where they have compared doses of 100mcg and 50mcg of dexmedetomidine as an adjuvant to levobupivacaine and observed an earlier onset of sensory block with the group receiving 100mcg of dexmedetomidine but the result was statistically insignificant.

In our study onset of motor block in group-I was (14.06±1.14 min) and (12.63±0.99 min) in group-II. It was found that addition of 75mcg of dexmedetomidine to ropivacaine results in early onset of motor block as compared with ropivacaine combined with 50mcg dexmedetomidine but, the difference was insignificant when compared statistically. The results coincide with the studies done by Nallam SR et al (2017)[14] where they they observed an early onset of motor block with 100mcg of dexmedetomidine group but, the result was statistically insignificant.

Duration of sensory block in group-I was (8.6±0.93 hours) and (10.53±1.33) hours in group-II (p <0.001) which was statistically significant. The result of our study coincides with Reddy IR et al (2018)[15] where they found the duration of sensory block in group receiving 50mcg of dexmedetomidine as an adjuvant to levobupivacaine as (765.2±138.5 min) and in group receiving 100mcg of dexmedetomidine with levobupivacaine as (902.4±122.8 min) which was statistically significant. Similar results of prolonged

duration of sensory block with addition of 100mcg of dexmedetomidine in comparison to 50mcg in brachial plexus block was found by Nallam SR et al (2017)[14].

Duration of motor block increased by addition of 75mcg dexmedetomidine (10.56±1.13 hours) than with 50mcg dexmedetomidine (7.06±0.86 hours) and the difference was significant ($p<0.001$). The result of our study coincides with Reddy IR et al (2018)[15] where they found that the duration of motor block in group receiving 50mcg of dexmedetomidine with levobupivacaine as (635.6±187.6 min) and in group receiving 100mcg of dexmedetomidine with levobupivacaine as (902.4±122.8 min) & the increase was statistically significant . Similar results of prolonged duration of motor block with addition of 100mcg of dexmedetomidine in comparison to 50mcg in brachial plexus block was found by Nallam SR et al (2017)[14].

In our study, though the sedation score were higher in dexmedetomidine 75mcg group as compared to dexmedetomidine 50mcg group,it was not significant. Similarly, Reddy IR et al (2018)[15] observed low sedation scores in patients who received 50mcg of dexmedetomidine in comparison to 100mcg.

There was significant increase in duration of analgesia in group-II (12.63±1.033 hours) compared to group-I (9.73±0.94 hours). The result of our study coincides with Reddy IR et al (2018)[15] where they found the duration of analgesia in group receiving 50mcg of dexmedetomidine as (784.6±139.8 min) and in group receiving 100mcg of dexmedetomidine as (1041.6±140.2 min) which showed statistically significant increase. Similar results of prolonged duration of analgesia with addition of 100mcg of dexmedetomidine in comparison to 50mcg in brachial plexus block was found by Nallam SR et al (2017)[14].

The results of our study clearly indicates that dexmedetomidine 75mcg provide better quality of postoperative analgesia than 50mcg dexmedetomidine group. The number of analgesic doses required in first 24 hours of block was (1.53±0.5) in group-II and (2.16±0.53) in group-I which is statistically highly significant ($p<0.0001$).

CONCLUSION

Hence, we conclude that 75mcg dexmedetomidine shown to have an upper edge over 50mcg dexmedetomidine in term of total duration of sensory and motor blockade, total duration of analgesia, decreased need of postoperative analgesic drugs, better operative conditions, comparable haemodynamic stability without increasing the side effects like sedation when used as an adjuvant to ropivacaine for brachial plexus block.

Acknowledgement - We are thankful to our teachers, fellow colleagues and orthopedics department for helping us in the study.
Financial Support– Nil
Conflicts of Interest- Nil

REFERENCES

1. Paul F White and Alejandro Racart Frerie Regional Anaesthesia. Millers Anaesthesia 6th Edition; Vol-2" 2609.
2. Winnie AP, Collins Vj. The Subclavian Perivascular technique of brachial plexus anaesthesia. Anesthesiology 1964; 25:353.
3. Urmey WF. Upper extremity blocks. In: Brown DL, editor. Regional Anaesthesia and Analgesia. Philadelphia: W.B. Saunders 1996: 254-78.
4. Arthur GR, Feldman HS Cavino BG. Comparative Pharamacokinetics of bupivacaine and ropivacaine a new amide local anesthetic, Anesth Analg 1988; 67: 1053-8.
5. Scott DB Lee A, Fagan D, Bowler GM, Bloomfield P lundh R. Acute toxicity of ropivacaine compared with that of bupivacaine. Anesth Analg 1989; 69: 563-9.
6. Kamibayashi T, Maze M. Clinical uses of a2-adrenergic agonists. Anesthesiology 2000;93:1345-9.
7. Stoelting RK, Hillier SC. Pharmacology and physiology in anaesthetic practice. 2006;4 th ed:340-5.
8. Kaur M, Singh PM. Current role of dexmedetomidine in clinical anesthesia and intensive 2011;5(2):128-33. care. Anaesthesia Essay Research
9. Grewal Anju. Dexmedetomidine: new avenue. J Anaesthetical Clin Pharmacol 2011;27(3):297-302.
10. Rajkhowa T, Das N, Paruna S, Kundu R. Fentanyl as an adjuvant for brachial plexus block; a randomized comparative study. Int J Clin Trials 2016; 3(2): 64-7.
11. Ammar AS, Mahmoud KM. Ultrasound guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexemedetomidine for pain control in upper limb surgery: A Prospective randomized controlled trial. Saudi J Anaesth 2012; 6(2): 109-14.
12. Lanz E, Theiss. D. Jankovic D. The extent of blockade following various techniques of Brachial plexus block. Anesth Analg 1983; 62:55-8.
13. Fischer HBJ. Brachial plexus anaesthesia In: Principles and practice of regional anaestheisa; Wildsmitis JAW, Armitag EN, Mc clure JH, editors third edition. London: Churchill Living Stone, 2003: 193-204.
14. Nallam SR, Chiruvella S, Karanam S. Supraclavicular brachial plexus block: comparison of varying doses of dexmedetomidine combined with levobupivacaine. A double blind randomised trial. Indian J Anaesth 2017;61: 256-61.
15. Reddy IR, Aasim SA, Kumar JM. Comparative study of varying doses of dexmedetomidine combined with levobupivacaine in supraclavicular brachial plexus block: a randomized double blind prospective study. International Journal of Research and Review. 2018; 5(11): 202-7