

Research Article



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EXAMINING THE VARIATIONS IN INTRAVENOUS AND PERINEURAL DEXMEDETOMIDINE SEDATED BRACHIAL PLEXUS BLOCK DURING A SPECIFIC APPROACH IN UPPER LIMB ORTHOPAEDIC SURGERY

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ABSTRACT

Background: The adjuvant analgesic dexmedetomidine is widely used in intravenous and intrathecal infusions. The function of perineural dexmedetomidine has also been discussed recently. Still, there is a dearth of information in the literature about the problem.

Aim: In this study, the effectiveness of intravenous vs perineural dexmedetomidine sedation on supraclavicular approach brachial plexus block during upper limb orthopaedic surgery was evaluated.

Methods: 80 subjects were split into two groups of 40 subjects each at random. Group I received a loading dose of 1 mcg/kg/IV dexmedetomidine for 10 minutes, after which they received a continuous IV infusion of 0.4 mcg/kg/hr of dexmedetomidine and Group II received 1 mcg/kg perineural dexmedetomidine. Along with any adverse effects experienced, the length and beginning of the motor and sensory block, the requirement for postoperative analgesics, haemodynamic parameters, and Ramsay sedation levels were evaluated in both groups.

Results: Group I had a substantially larger mean sensory block onset ($p < 0.05$), whereas the mean motor block onset in the two groups was similar ($p > 0.05$). Group I experienced a considerably longer period of motor and sensory blockage ($p < 0.05$). Throughout the course of the study, Group I patients had reduced pulse rates, systolic and diastolic blood pressure, and equivalent SpO₂ values. The Ramsay sedation score did not change. At 9, 12, and 15 hours postoperatively, Group I had noticeably lower scores ($p < 0.05$). Group I had a substantially greater mean analgesia rescue time with VAS > 4 ($p < 0.05$).

Conclusions: The current study comes to the conclusion that, when compared to perineural dexmedetomidine, which is used as an adjuvant to supraclavicular block using 2% of 5 mg/kg lidocaine and 0.5% of 2 mg/kg bupivacaine for upper limb orthopaedic surgeries, early sensory block onset was seen with significantly longer duration of analgesia, motor, and sensory block.

Keywords: bupivacaine, dexmedetomidine, lignocaine, supraclavicular block, upper limb surgery

INTRODUCTION

Orthopaedic doctors frequently undertake surgical treatments in the field of orthopaedics. These orthodontic treatments are often unpleasant processes that call for the use of analgesics as essential agents in lieu of intravenous (IV) opioid pain management and general anaesthesia.¹ A common technique for regional anaesthesia used in operations involving the hands, forearm, and arm is brachial plexus blocking. Anatomical routes used in these procedures include axillary, infraclavicular, supraclavicular, and interscalene.²

Alpha 2 agonists have been shown to have sedative effects and to lessen the need for opioid analgesics during the perioperative period. This suggests that the powerful analgesic action of these agents can be mediated by both supraspinal mechanisms in the locus coeruleus and spinal mechanisms in the dorsal horn of the spinal cord.³

In addition to being a highly selective alpha 2 adrenergic receptor agonist, dexmedetomidine is a well used and recognised analgesic and anaesthetic. Since dexmedetomidine does not cause significant respiratory adverse effects, it is most frequently used as a short-term sedative and during shorter surgical operations in patients who are hospitalised to the critical care unit and require mechanical ventilation. ^{4,5}

Based on evidence from the literature, anti-hyperalgesic activity in rats with neuropathic pain originating in the peripheral nervous system enhances the effectiveness of analgesics without causing additional or worsening adverse effects. With its opioid-sparing effects and anxiolytic, sedative, hypnotic, and analgesic qualities, dexmedetomidine is a potentially helpful medication for usage during pain surgical procedures such as orthopaedic surgery.⁶

The purpose of the current study was to compare the effectiveness of intravenous and perineural dexmedetomidine sedation for supraclavicular approach brachial plexus block during upper limb orthopaedic surgery.

METHODS AND MATERIALS

Assessing the effectiveness of intravenous Dexmedetomidine sedation vs perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block during upper limb orthopaedic surgery was the goal of the current prospective randomised clinical trial. Participants in the research were from the Institute's Department of Orthopaedic Surgery. Prior to their involvement in the study, all individuals provided their written and verbal informed consent.

With a mean age of 34.6 ± 6.84 years, the research had 80 patients of both genders, ranging in age from 18 to 60. Subjects having to undergo upper limb orthopaedic surgery, weighing between 40 and 70 years, age between 18 and 60 years, and ASA (American Society of Anaesthesiologists) status I or II were the inclusion criteria for the study. Subjects having a history of bleeding diathesis, renal and/or respiratory failure, heart illness, allergy to study medication, shoulder joint pathology, and pregnancy were among the exclusion criteria for this research.

The research participants were split into two groups of forty each at random. Group II patients received 1mcg/kg perineural dexmedetomidine, while Group I individuals received a loading dose of 1mcg/kg/IV dexmedetomidine from a 50ml infusion syringe for 10 minutes, followed by a continuous IV infusion of 0.4mcg/kg/hr. The contralateral arm was given an IV cannula to provide Ringer acetate solution at a 5 millilitre per kilogramme per hour infusion rate. The non-invasive techniques of blood pressure measurement, pulse oximetry for SpO₂, and electrocardiography (ECG) were used to monitor every individual.

The supine posture was adopted for all individuals, with the arm abducted to achieve a 90-degree angle with the body. The forearm was then twisted and externally flexed to position the hand next to the head, with the palm facing downward. Following this, the supraclavicular area was cleaned, and a needle was put into it under very rigorous aseptic and sterile circumstances.

The next step was identifying the nerves by employing a needle-based nerve stimulator to produce contractions in the muscles that are supplied by specific nerves at a current of 1 mA, which was sufficient to do so without producing discomfort. The nerve was found in the following order: ulnar (flexion of the fourth and fifth fingers together with thumb adduction), median (pronation and flexion of the wrist, second, and third finger), and musculocutaneous nerve (flexion of the arm).

After attaining the desired response and needle stabilization, 40 ml of local anesthetic agent as 0.5% of 2mg/kg bupivacaine and 5mg/kg of 2% lidocaine with 1:200,000 lidocaine was given to both groups. Group II with perineural dexmedetomidine was also administered perineural dexmedetomidine with the block.

For the musculocutaneous, medial, radial, and ulnar nerves—among the main peripheral nerve distributions—sensory block onset was measured from the moment of injection until the beginning of analgesia. The period of sensory blocking extended from the moment of drug injection to the point at which the visual analogue scores (VAS) increased to 3. The time interval between the drug injection and total loss of elbow flexion, the opposition of the thumb and index finger for the median nerve the opposition of the thumb and little finger for the ulnar nerve, and the extension of the wrist and elbow for the radial nerve were used to determine the start of the motor block. The period

between a drug injection and the full restoration of motor power was measured as the motor block duration. Haemodynamic measures (blood pressure, heart rate, and SpO₂), as well as the beginning and length of motor and sensory blocks, were recorded.

Additionally evaluated were side effects, the necessity for surgical analgesia, and Ramsay sedation levels. The length of analgesia was measured as the interval from block end to the initial analgesia request. A VAS of 10 points was used to assess the degree of pain at the moment rescue analgesia was requested; 0 represented no pain and 10 the worst possible agony. When VAS >4, rescue analgesia was administered by IV injection of 75 mg of Diclofenac.

The collected data were statistically analysed using the IBM Corp., Armonk, NY, USA's SPSS (Statistical Package for the Social Sciences) software version 21.0 for the assessment of descriptive measures, the Mann Whitney U test, the chi-square test, and the Mann Whitney U test for non-parametric data, and the independent t-test for parametric data. The findings were presented as percentages, frequency, mean, and standard deviation. The p-value of <0.05 was considered statistically significant.

RESULTS

The 80 participants in the study were randomly assigned to two groups of 40 subjects each. Group I received a loading dose of 1 mcg/kg/IV dexmedetomidine for 10 minutes, followed by a continuous IV infusion of 0.4 mcg/kg/hr, and Group II received 1 mcg/kg perineural dexmedetomidine. The age range of the research participants was 18-58 years for Group II and 31.3±12.2 years for Group I, with a statistically non-significant difference at $p>0.05$. The mean age of the study subjects was 32.01±9.8 years. In Groups I and II, the mean weight of the study participants was 52.2±9.6 and 51.4±9.8 years, respectively, with $p>0.05$. Results were statistically non-significant with $p>0.05$. In Group I, there were 75% (n=30) men and 25% (n=10) females, while in Group II, there were 80% (n=32) males and 20% (n=8) females. As indicated in Table 1, ASA status I and II were seen in 65% (n=26) and 35% (n=14) of the participants from Group II and 55% (n=22) and 45% (n=18) of the subjects from Group I, respectively. These results were non-significant with $p>0.05$.

The research's findings demonstrated that, when different parameters were examined between the two study subject groups, the mean time for rescue analgesia with VAS >4 in Group I was 1320±274 minutes, a significant difference from 1156±262 minutes in Group II ($p=0.007$). Group I individuals had a mean motor block duration of 800±112 minutes, substantially longer than Group II subjects' mean length of 600±103 minutes ($p<0.0001$).

Group I individuals had a substantially longer sensory block duration (672±100 minutes) than Group II subjects (542±92 minutes), with a p-value of less than 0.0001. Group I and Group II had mean onset durations of 6.1±2.3 and 6.5±2.9 minutes, respectively, which were statistically equivalent at $p=0.4963$. As shown in Table 2, Group II's mean onset length for the sensory block was 3.4±1.2 minutes, substantially longer than Group I's 2.4±1.4 minutes ($p=0.0001$).

When the haemodynamic characteristics of the two study groups were compared, it was seen that the participants in Group I who received intravenous dexmedetomidine had a lower pulse rate than the subjects in Group II who received perineural dexmedetomidine. Systolic and diastolic blood pressure readings were similar, with Group I participants having lower readings than Group II participants. Nonetheless, during the course of the trial, Group I and Group II patients' SpO₂ readings were similar. Regarding the research subjects' side effects, it was observed that Group I patients had asymptomatic bradycardia and reacted favourably to 0.6 mg intravenous atropine. During the intraoperative phase, Ramsay sedation ratings showed no discernible intergroup difference with $p>0.05$. Ramsay sedation scores obtained 9, 12, and 15 hours after surgery, however, revealed notably superior outcomes for Group I in contrast to Group II ($p<0.05$).

DISCUSSION

The 80 participants in this study were randomly assigned to two groups of 40 subjects each. Group I received a loading dose of 1 mcg/kg/IV dexmedetomidine for 10 minutes, followed by a continuous IV infusion of 0.4 mcg/kg/hr, and Group II received 1 mcg/kg perineural dexmedetomidine. The research subjects' mean age was 31.3±12.2 and 32.01±9.8 years, respectively, with age ranges of 19-61 and 18-58 years in Group I and Group II. The difference in age was statistically not significant, with $p>0.05$. The study subjects' mean weight was 52.2±9.6 years for Group I and 51.4±9.8 years for Group II, with $p>0.05$. Results were statistically non-significant with $p>0.05$. In

Group I, there were 75% (n=30) men and 25% (n=10) females, while in Group II, there were 80% (n=32) males and 20% (n=8) females.

It was not statistically significant with $p > 0.05$ that 55% (n=22) and 45% (n=18) of the participants in Group I and 65% (n=26) and 35% (n=14) of the subjects in Group II, respectively, had ASA status I and II. The present study's findings bore similarities to those of studies conducted in 2013 by Hanoura SE et al⁷ and in 2011 by Sarsu S et al⁸, in which the authors evaluated participants with similar demographics and undergoing brachial plexus block. When several parameters were evaluated across the two research subject groups, it was observed that the mean time for rescue analgesia with VAS > 4 in Group I was 1320 ± 274 minutes, which was substantially longer than the mean of Group II at 1156 ± 262 minutes ($p = 0.007$).

The mean duration of motor block in Group I subjects was 800 ± 112 minutes which was significantly higher compared to Group II where it was 600 ± 103 minutes with $p < 0.0001$. Group I individuals had a substantially longer sensory block duration (672 ± 100 minutes) than Group II subjects (542 ± 92 minutes), with a p-value of less than 0.0001. Group I and Group II had mean onset durations of 6.1 ± 2.3 and 6.5 ± 2.9 minutes, respectively, which were statistically equivalent at $p = 0.4963$. Group II experienced a substantially longer mean onset length for the sensory block (3.4 ± 1.2 minutes) than Group I (2.4 ± 1.4 minutes; $p = 0.0001$). These findings aligned with the research conducted by Movafegh A et al. (2009) and Esmaoglu A et al. (2010), who found improved parameters for sensory and motor block, duration, and onset in their separate trials, as demonstrated by the current investigation.

The study's findings demonstrated that, when haemodynamic parameters were measured in two groups of participants, the pulse rate of Group I recipients of intravenous dexmedetomidine was found to be lower than that of Group II recipients of perineural dexmedetomidine. Systolic and diastolic blood pressure readings were similar, with Group I participants having lower readings than Group II participants. Nonetheless, during the course of the trial, Group I and Group II patients' SpO₂ readings were similar. These results were consistent with those of et al. (2010) and Mizrak A. et al. (2010), whose haemodynamic parameters following perineural and intravenous dexmedetomidine were similar to those of the current investigation.

Regarding the research subjects' side effects, it was observed in this investigation that Group I patients had asymptomatic bradycardia and reacted favourably to 0.6 mg intravenous atropine. During the intraoperative phase, Ramsay sedation ratings showed no discernible intergroup difference with $p > 0.05$. Ramsay sedation scores obtained 9, 12, and 15 hours after surgery, however, revealed notably superior outcomes for Group I in contrast to Group II ($p < 0.05$). These results were in agreement with those of Al-Mustafa MM et al.¹³ in 2009 and Unlugenc H et al.¹⁴ in 2005, whose authors reported side effects comparable to the current study following the administration of intravenous and perineural dexmedetomidine for brachial plexus block in their respective investigations.

CONCLUSIONS

Taking into account its limitations, the current study comes to the conclusion that, when compared to perineural dexmedetomidine used as an adjuvant to supraclavicular block using 2% of 5 mg/kg lidocaine and 0.5% of 2 mg/kg bupivacaine used for upper limb orthopaedic surgeries, early sensory block onset was seen with significantly longer duration of analgesia, motor, and sensory block. To get a firm conclusion, however, further multi-institutional research evaluating participants from various backgrounds and locations is required.

REFERENCES

1. Klaastad O, Sauter AR, Dodgson MS: Brachial plexus block with or without ultrasound guidance. *Curr Opin Anaesthesiol.* 2009;22:655- 60.
2. Jafari S, Kalstein AI, Nasrullah HM, Hedayatnia M, Yarmush JM, SchianodiCola J: A randomized, prospective, double-blind trial comparing 3% chloroprocaine followed by 0.5% bupivacaine to 2% lidocaine followed by 0.5% bupivacaine for interscalene brachial plexus block. *Anesth Analg.* 2008;107:1746-50.
3. Cortinez LI, Hsu YW, Sum-Ping ST, et al.: Dexmedetomidine pharmacodynamics: part II. Crossover comparison of the analgesic effect of dexmedetomidine and remifentanyl in healthy volunteers. *Anesthesiology.* 2004;101:1077-83.

4. Arain SR, Ruehlow RM, Uhrich TD, Ebert TJ: The efficacy of dexmedetomidine versus morphine for postoperative analgesia after major inpatient surgery. *Anesth Analg.* 2004;98:153-8
5. Marinangeli F, Ciccozzi A, Donatelli F, et al.: Clonidine for treatment of postoperative pain: a dose-finding study. *Eur J Pain.* 2002;6:35-42.
6. De Tran QH, Clemente A, Doan J, Finlayson RJ: Brachial plexus blocks: a review of approaches and techniques. *Can J Anaesth.* 2007;54:662-74.
7. Hanoura SE, Elsayed MM, Abdullah AA, Elsayed HO, Nor Eldeen TM: Dexmedetomidine improves the outcome of a bupivacaine brachial plexus axillary block: a prospective comparative study. *Ain-Shams J Anesthesiol.* 2013;6:58-62.
8. Sarsu S, Mizrak A, Karakurum G: Tramadol used for axillary brachial plexus blockade. *J Surg Res.* 2011;65:23-7.
9. Movafegh A, Nouralishahi B, Sadeghi M, Nabavian O: An ultra-low dose of naloxone added to lidocaine or lidocaine-fentanyl mixture prolongs axillary brachial plexus blockade. *Anesth Analg.* 2009;109:1679-83.
10. Esmaoglu A, Yegenoglu F, Akin A, Turk CY: Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg.* 2010;111:1548-51.
11. Obayah GM, Refaie A, Aboushanab O, Ibraheem N, Abdelazees M: Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. *Eur J Anaesthesiol.* 2010;27:280-4.
12. Mizrak A, Gul R, Erkuclu I, Alptekin M, Oner U: Premedication with dexmedetomidine alone or together with 0.5% lidocaine for IVRA. *J Surg Res.* 2010;164:242-7.
13. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, et al.: Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. *Saudi Med J.* 2009;30:365-70.
14. Unlugenc H, Gunduz M, Guler T, Yagmur O, Isik G: The effect of pre-anesthetic administration of intravenous dexmedetomidine on postoperative pain in patients receiving patient-controlled morphine. *Eur J Anaesth.* 2005;22:386-91.

TABLES

S. No	Characteristics	Group I (n=40)		Group II (n=40)		p-value
		n	%	n	%	
1.	Mean age (years)	31.3±12.2		32.01±9.8		>0.05
2.	Age range	19-61		18-58		>0.05
3.	Mean weight (Kg)	52.2±9.6				>0.05
4.	Gender					
a)	Males	30	75	32	80	>0.05
b)	Females	10	25	8	20	
5.	ASA status					
a)	I	22	55	26	65	>0.05
b)	II	18	45	14	35	

Table 1: Demographic characteristics of the study subjects in two groups

S. No	Parameters	Group I	Group II	p-value
1.	Mean time to rescue analgesia VAS >4 (mins)	1320±274	1156±262	0.007
2.	Mean motor block duration (mins)	800±112	600±103	<0.0001
3.	Mean sensory block duration (mins)	672±100	542±92	<0.0001
4.	Mean motor block onset (mins)	6.1±2.3	6.5±2.9	0.4963
5.	Mean sensory block onset (mins)	2.4±1.4	3.4±1.2	0.0001

Table 2: Comparison of various parameters in two groups of study subjects