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STUDYING THE COMPARISON OF INTRAVENOUS DEXMEDETOMIDINE SEDATION TO PERINEURAL DEXMEDETOMIDINE ON SUPRACLAVICULAR APPROACH BRACHIAL PLEXUS BLOCK DURING UPPER LIMB ORTHOPEDIC SURGERY

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ABSTRACT

Background: Dexmedetomidine is frequently used as an adjuvant analgesic in both intrathecal and intravenous infusions. Recently, the role of perineural dexmedetomidine has also been addressed. However, existing literature data is scarce concerning the issue.

Aim: The present study aimed to assess the efficacy of intravenous Dexmedetomidine sedation to Perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block during upper limb orthopedic surgery.

Methods: 80 subjects were randomly divided into two groups of 40 subjects each where Group I subjects were given 1mcg/kg/IV dexmedetomidine as a loading dose for 10 minutes followed by continuous 0.4mcg/kg/hr IV dexmedetomidine infusion and Group II subjects were given 1mcg/kg perineural dexmedetomidine. In both the groups, duration and onset of motor and sensory block, postoperative analgesia need, hemodynamic parameters, and Ramsay sedation scores were assessed along with any encountered side-effect.

Results: Mean sensory block onset was significantly higher in Group I with $p<0.05$, however, mean motor block onset was comparable in two groups with $p>0.05$. Motor and sensory blockade duration was significantly longer in Group I ($p<0.05$). Group I subjects showed lower systolic and diastolic blood pressure and lower pulse rate throughout the duration, and SpO2 levels were comparable. No difference in Ramsay sedation score was seen in either group, however, significantly lesser scores were seen at 9, 12, and 15 hours postoperatively in Group I ($p<0.05$). Mean analgesia rescue time with VAS >4 was higher in Group I significantly ($p<0.05$).

Conclusions: The present study concludes that early sensory block onset was seen in IV dexmedetomidine with significantly longer duration of analgesia, motor, and sensory block in comparison to perineural dexmedetomidine used as an adjuvant to supraclavicular block using 2% of 5mg/kg Lidocaine and 0.5% of 2mg/kg bupivacaine used for upper limb orthopedic surgeries.

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

INTRODUCTION

Orthopedic surgical procedures are common surgical practices being performed by orthopedic surgeons. These orthodontic surgeries are generally painful procedures that usually require analgesics that are alternative to intravenous (IV) opioid pain therapy and to general anesthesia as vital agents.[1] Brachial plexus blockade is a regional anesthesia method that is usually employed in surgeries involving atm, forearm, and hands utilizing the different anatomical approaches including axillary, infraclavicular, supraclavicular, and inter scalene approach.[2]

Systemic administration of alpha 2 agonists is been reported to pose the effects of sedative agents and to reduce the need for opioid analgesics in the perioperative period which provides evidence that these agents have a potent analgesic action which can be mediated using both the spinal mechanism in the dorsal horn of spinal cord and supraspinal mechanisms in locus coeruleus.[3]

Dexmedetomidine is a widely used and accepted analgesic and anesthetic agent which is also a highly selective alpha 2 adrenergic receptor agonist. Dexmedetomidine is most commonly used as a sedative agent of short-term duration and shorter surgical procedures in subjects admitted to the intensive care unit and requiring mechanical ventilation as dexmedetomidine does not lead to major respiratory side-effects. [4,5]

Existing literature data has reported that anti-hyperalgesic action in rats having neuropathic pain arising in the peripheral nervous system increases the effects of analgesic agents with no extra or increased side effects. The anxiolytic, sedative, hypnotic, and analgesic properties of dexmedetomidine and its opioid-sparing effects make dexmedetomidine a potentially useful agent for use during pain surgical procedures as orthopedic surgeries.[6]

The present study was aimed at comparatively assessing the efficacy of intravenous Dexmedetomidine sedation to Perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block during upper limb orthopedic surgery.

MATERIALS AND METHODS

The present prospective randomized clinical study was aimed at assessing the efficacy of intravenous Dexmedetomidine sedation to Perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block during upper limb orthopedic surgery. The Study was done at RSDKS Government Medical College and Associated Hospital Ambikapur, Surguja, Chhattisgarh. The study subjects were from the Department of Orthopedic Surgery of the Institute. Verbal and written informed consent were taken from all the subjects before study participation.

The study included 80 subjects from both genders in the age range of 18-60 years and a mean age of 34.6±6.84 years. The inclusion criteria for the study were subjects that had to undergo orthopedic surgery in the upper extremity, the weighting of 40-70 years, age 18-60 years, and in ASA (American Society of Anesthesiologists) status I and II. The exclusion criteria for the study were subjects that were pregnant, subjects with renal and/or respiratory failure, cardiac disease, allergy to the study drugs, pathology of the shoulder joint, and bleeding diathesis history subjects.

The study subjects were divided randomly into two groups having 40 subjects each. Group I subjects were given 1mcg/kg/IV dexmedetomidine as a loading dose for 10 minutes from a 50ml infusion syringe followed by continuous 0.4mcg/kg/hr IV dexmedetomidine infusion and Group II subjects were given 1mcg/kg perineural dexmedetomidine. An IV cannula was placed in the contralateral arm to administer Ringer acetate solution at a rate of 5ml/kg/hour infusion. All the subjects were monitored using a non-invasive method of ECG (electrocardiography), pulse oximetry for SpO2, and blood pressure assessment.

All the subjects were placed in the supine position with an abducted arm to attain a 90-degree angle to the body, and the forearm was externally flexed and rotated to place the hand next to the head and the palm was then positioned facedown. This was followed by disinfection of the supraclavicular region and under strict aseptic and sterile conditions, a needle was inserted into the supraclavicular region.

This was followed by the identification of the nerves by stimulating the muscles that are supplied by certain nerves to contract by applying a current of 1mA which was adequate to cause contractions without causing pain with the nerve stimulator via needle. The nerve was identified in order of radial (supination and extension of fingers and arm) followed by median by pronation and flexion of the wrist, second, and third finger), ulnar (flexion of fourth and fifth finger along with thumb adduction), and musculocutaneous nerve by arm flexion. 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.

Sensory block onset was taken from the time of injection to analgesia onset in each of the major peripheral nerve distributions including musculocutaneous, medial, radial, and ulnar nerves. Sensory blockade duration was the time between drug injection to onset of VAS (visual analog score) >3. Motor block onset was taken as the time between drug injection to complete loss of elbow flexion (musculocutaneous nerve), the opposition of the thumb and little finger for ulnar nerve, the opposition of thumb and index finger for median nerve, and extension of wrist and elbow for radial nerve. Motor block duration was taken as the time between drug injection to complete motor power return. The parameters recorded were hemodynamic parameters such as SpO2, blood pressure, and pulse rate), onset, and duration of motor and sensory blocks.

Side effects, postoperative analgesia need, and Ramsay sedation scores were also assessed. Analgesia duration was taken as the time between the block end to the first request for analgesia. Pain severity at the time of request of rescue analgesia was rated in VAS of 10-points where 0 signified no pain and 10 showed the worst imaginable pain. Rescue analgesia was given as an IV dose of 75mg of Diclofenac when VAS >4.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 21.0 (IBM corp., Armonk. NY, USA) for assessment of descriptive measures, Mann Whitney U test, and chi-square test for non-parametric data and with independent t-test for parametric data. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective randomized clinical study was aimed at comparatively assessing the efficacy of intravenous Dexmedetomidine sedation to Perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block during upper limb orthopedic surgery. The study assessed 80 subjects who were randomly divided into two groups of 40 subjects each where Group I subjects were given 1mcg/kg/IV dexmedetomidine as a loading dose for 10 minutes followed by continuous 0.4mcg/kg/hr IV dexmedetomidine infusion and Group II subjects were given 1mcg/kg perineural dexmedetomidine. The mean age of the study subjects was 31.3±12.2 and 32.01±9.8 years and the age range were 19-61 and 18-58 years in Group and Group II which was the statistically non-significant difference with $p>0.05$. The mean weight of the study subjects was 52.2±9.6 and 51.4±9.8 years in Groups I and II respectively with $p>0.05$. There were 75% (n=30) males and 25% (n=10) females in Group I and 80% (n=32) males and 20% (n=8) females in Group II respectively showing statistically non-significant results with $p>0.05$. ASA status I and II was seen in 55% (n=22) and 45% (n=18) subjects from Group I and in 65% (n=26) and 35% (n=14) subjects from Group II respectively which was non-significant with $p>0.05$ as shown in Table 1.

The study results showed that for comparison of various parameters in two groups of study subjects, the mean time for rescue analgesia with VAS >4 was 1320±274 minutes in Group I which was significantly higher compared to 1156±262 in Group II with $p=0.007$. 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 $p<0.0001$. The mean duration of sensory block was 672±100 and 542±92 minutes in Group I and II subjects which was significantly higher in Group I with $p<0.0001$. The mean onset duration for Group I and Group II was 6.1±2.3 and 6.5±2.9 minutes which was statistically comparable with $p=0.4963$. The mean onset duration for the sensory block was significantly higher for Group II with 3.4±1.2 minutes compared to 2.4±1.4 minutes for Group I with $p=0.0001$ as summarized in Table 2.

It was seen that on assessing the hemodynamic parameters in two groups of study subjects, it was seen that in Group I subjects administered with intravenous dexmedetomidine, pulse rate was lower when compared to subjects of Group II that were given perineural dexmedetomidine. Similar results were seen for systolic and systolic blood pressure which was lower in Group I subjects when compared to the subjects from Group II. However, the values of SpO2 were comparable in Group I and Group II subjects throughout the study period.

Concerning the side effects in study subjects, it was noted that Group I subjects presented with asymptomatic bradycardia, and these subjects responded well to 0.6 mg intravenous atropine. Ramsay sedation scores depicted no significant intergroup difference during the intraoperative period with $p>0.05$. However, Ramsay sedation scores postoperatively at 9, 12, and 15 hours showed significantly better results for Group I compared to Group II with $p<0.05$.

DISCUSSION

The present study assessed 80 subjects who were randomly divided into two groups of 40 subjects each where group I subjects were given 1mcg/kg/IV dexmedetomidine as loading dose for 10 minutes followed by continuous 0.4mcg/kg/hr IV dexmedetomidine infusion and Group II subjects were given

1mcg/kg perineural dexmedetomidine. The mean age of the study subjects was 31.3±12.2 and 32.01±9.8 years and age ranges were 19-61 and 18-58 years in Group and Group II which was the statistically non-significant difference with p>0.05. The mean weight of the study subjects was 52.2±9.6 and 51.4±9.8 years in Groups I and II respectively with p>0.05. There were 75% (n=30) males and 25% (n=10) females in Group I and 80% (n=32) males and 20% (n=8) females in Group II respectively showing statistically non-significant results with p>0.05. ASA status I and II were seen in 55% (n=22) and 45% (n=18) subjects respectively from Group I and in 65% (n=26) and 35% (n=14) subjects respectively from Group II respectively which was non-significant with p>0.05. These data were similar to the studies of Hanoura SE et al[7] in 2013 and Sarsu S et al[8] in 2011 where authors assessed subjects with comparable demographics and undergoing brachial plexus block as seen in the present study.

It was seen that for comparison of various parameters in two groups of study subjects, the mean time for rescue analgesia with VAS >4 was 1320±274 minutes in Group I which was significantly higher compared to 1156±262 in Group II with 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. The mean duration of sensory block was 672±100 and 542±92 minutes in Group I and II subjects which was significantly higher in Group I with p<0.0001. The mean onset duration for Group I and Group II was 6.1±2.3 and 6.5±2.9 minutes which was statistically comparable with p=0.4963. The mean onset duration for the sensory block was significantly higher for Group II at 3.4±1.2 minutes compared to 2.4±1.4 minutes for Group I with p=0.0001. These results were consistent with the studies of Movafegh A et al[9] in 2009 and Esmaoglu A et al[10] in 2010 where authors reported better parameters related to sensory block and motor block, duration, and onset as seen in the present study in their respective studies.

The study results showed that on assessing the hemodynamic parameters in two groups of study subjects, it was seen that in Group I subjects administered with intravenous dexmedetomidine, pulse rate was lower when compared to subjects of Group II that were given perineural dexmedetomidine. Similar results were seen for systolic and systolic blood pressure which was lower in Group I subjects when compared to the subjects from Group II. However, the values of SpO2 were comparable in Group I and Group II subjects throughout the study period. These findings were in agreement with the results of et al[11] in 2010 and Mizrak A et al[12] in 2010 where hemodynamic parameters reported by the authors in their studies were comparable to the present study after perineural and intravenous dexmedetomidine.

The present study depicted that concerning the side-effects in study subjects, it was noted that Group I subjects presented with asymptomatic bradycardia, and these subjects responded well to 0.6 mg intravenous atropine. Ramsay sedation scores depicted no significant intergroup difference during the intraoperative period with p>0.05. However, Ramsay sedation scores postoperatively at 9, 12, and 15 hours showed significantly better results for Group I compared to Group II with p<0.05. These results correlated to the findings of Al-Mustafa MM et al[13] in 2009 and Unlugenc H et al[14] in 2005 where side effects similar to the present study were reported by the authors in their respective studies after administration of intravenous and perineural dexmedetomidine for brachial plexus block.

CONCLUSIONS

Considering its limitations, the present study concludes that early sensory block onset was seen in IV dexmedetomidine with significantly longer duration of analgesia, motor, and sensory block in comparison to perineural dexmedetomidine used as an adjuvant to supraclavicular block using 2% of 5mg/kg Lidocaine and 0.5% of 2mg/kg bupivacaine used for upper limb orthopedic surgeries. However, further multi-institutional studies assessing subjects from different backgrounds and geographical areas are needed for a definitive conclusion.

REFERENCES

1. Cortinez LI, Hsu YW, Sum-Ping ST, et al.: Dexmedetomidine pharmacodynamics: part II. Crossover comparison of the analgesic effect of dexmedetomidine and remifentanil in healthy volunteers. Anesthesiology. 2004;101:1077-83.

2. 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

3. 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.

4. Klaastad O, Sauter AR, Dodgson MS: Brachial plexus block with or without ultrasound guidance. Curr Opin Anaesthesiol. 2009;22:655- 60.

5. 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.

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, Erkutlu 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