



Original Research Article

Dexmedetomidine as an adjuvant for extension of postoperative analgesia in ropivacaine induced supraclavicular brachial plexus block

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ABSTRACT

Background & Method: Pain is recognized as the fifth vital sign. The pain must be adequately treated esp. in postoperative period. The study was carried out at Department of Anesthesiology, Sri Aurobindo Institute of Medical Sciences Indore. The aim of the study was to assess the role of Dexmedetomidine in extension of post-operative analgesia. The study included 88 participants who were equally divided randomly into two groups i.e. with and without Dexmedetomidine intervention after the inclusion and exclusion criteria's.

Result: The duration of post-operative analgesia in both groups indicating that contemplated surgery could be finished without need for additional analgesic supplement as the minimum and maximum time for surgery were within the range of effective analgesia without movement of limb. The time for demand of dose of rescue analgesic by the patients in both groups was 493.6±48.6 minutes and 961.0±141.6 minutes. The Dexmedetomidine group had a less demand of rescue analgesia. (P = 0.000). Whereas 23(52.2%) patients of Nonintervention group needed 2 to 4 doses of injection of diclofenac sodium by intramuscular route to control pain.

Conclusion: Addition of Dexmedetomidine 100 mcg to ropivacaine 0.5% solution for conduct of supraclavicular block improved the block quality and provided prolonged postoperative pain free period and decreased the demand of systemic analgesics.

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1. Introduction

Brachial plexus blocks provide alternative for general anesthesia for upper limb surgeries and provide ideal operative conditions. Various drugs have been used as adjuvants to modify the block in terms of onset, quality, duration and post-operative analgesia. Bupivacaine is the most frequently used local anesthetic due to its long duration of action (4-8 hours).¹ Adjuvants of recent interest include alpha 2 agonists- like clonidine, dexmedetomidine.

Clonidine, an α_2 -adrenergic agonist, has been used as an adjuvant to local anesthetics in regional anesthesia.² It is demonstrated that adding clonidine to intermediate and long-acting local anesthetics during a single-shot peripheral nerve or nerve plexus block provides a longer duration of

analgesia and motor blockade by approximately 2 hours.

Dexmedetomidine is a dextro-enantiomer and active component of medetomidine approved as intravenous sedative and co analgesic drug. Its α_2/α_1 selectivity ratio is 8 times than that of clonidine.^{3,4}

Studies comparing clonidine and dexmedetomidine an adjuvant to bupivacaine are reported in literature for blind technique of supraclavicular brachial plexus block. High dose of α_2 agonists is associated with side effects like hypotension and bradycardia. Very few studies have so far compared low dose of clonidine and dexmedetomidine.⁵

Among the different techniques of supraclavicular brachial plexus block, the classical approach using paresthesia being a blind technique is associated with higher failure rates, injury to nerves and vascular structures. The requirement of higher volume and concentration of local

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anesthetics as well as adjuvants decreases the safety margin in paresthesia technique. Blocks using peripheral nerve stimulator also can cause injury to nerves and vascular structures.⁶ Recently, the use of USG guidance for exact localization of nerve plexus has revolutionized the technique of regional anesthesia.⁷ It has improved the success rate as well as safety along with marked reduction of the dose of local anesthetics. Hence, we decided to compare the efficacy of low dose adjuvants like clonidine and dexmedetomidine in USG guided supraclavicular block.⁸

2. Materials and Methods

The aim of the present study is to assess the role of Dexmedetomidine in extension of post-operative analgesia and also its intraoperative effects in ropivacaine induced supraclavicular brachial plexus block. The study was carried out at Department of Anesthesiology, Sri Aurobindo Institute of Medical Sciences Indore. The randomized controlled study involves observations on 88 patients of ASA grade I and II between age group 20-50 years, scheduled to undergo orthopedics surgery. After the approval from the hospital ethics committee and with the consent from the participants the study was carried out.

2.1. Inclusion criteria

1. Patients belonging to physical status classification I and II as per American society of Anesthesiologists.
2. Age group 20-50 years of both sexes.
3. Patients scheduled for elective upper limb orthopedic surgery.

2.2. Exclusion criteria

1. Patient with known hypersensitivity to study drugs.
2. Infection at the site of block.
3. Patient with known coagulopathy or patient on anticoagulants.
4. Patients with severe systemic disorder (respiratory, cardiac, hepatic, renal diseases).
5. Pregnant and lactating women.
6. Patients with neurological, psychiatric or neurovascular disorder.
7. Patients belonging to physical status classification III and IV as per American society of anesthesiologists.

2.3. Drop out arrangement

The patients who did not had complete effect of brachial plexus block to allow surgery even after 20-30 minutes of block administration were withdrawn from the study and a new patient fulfilling inclusion criteria was recruited.

2.4. Study procedure

Patients were evaluated thoroughly in preanesthetic checkup a day prior to surgery. During the pre-anesthetic evaluation a General and systemic examination was done. During the Preoperative visit, anesthesia procedure to be undertaken was explained to the patients to alleviate the fear and anxiety of the patients. The participants were explained how to quantify their pain on visual analog scale. Airway assessment was also carried out in instances of failed block and need to administer general anesthesia.

Routine laboratory tests were conducted to rule out co-morbid conditions that included complete hemogram, blood counts, urine analysis, fasting and post meal glucose estimation and serum creatinine and whenever preoperative history suggested, coagulation profile, ECG and chest X-ray was done.

A written consent was obtained after counseling and explaining the procedure for inclusion in the study. Patients were instructed not to take anything orally for 6-8 hours before surgery. Availability of necessary resuscitation equipment, Anesthesia machine gas inlets connected to pipeline supply and drugs needed for administration of general anesthesia was confirmed. Intravenous access was established in the limb opposite to that undergoing surgery with 18 G cannula. The dose of dexmedetomidine was standardized and was administered accordingly to patients. The consented patients were divided randomly in to 2 groups. Both the groups were distributed randomly along with age, gender and other parameters matched. One of the groups was given Dexmedetomidine as an adjuvant to extend post-operative analgesia while other group was not given anything other than routine medications. Among the two groups, Group A was without Dexmedetomidine (without intervention) and Group B with Dexmedetomidine (with intervention).

2.5. Sample size

To calculate the sample size based on the prevalence with 99% confidence level, we used the following formula:

$$n = Z^2 * P * (100 - P) / d^2$$

Where

Z=2.58 AT 95% Confidence interval

P=7% (prevalence of complication bradycardia in Group D 7% ref. no...)

L= absolute error=10%

$$n = (2.58^2 * 7 * (100 - 7) / 10^2) = 88$$

4 Cases in each group total sample size 44+44=88.

The minimum sample size calculated by this formula was 88. But the sample size was rounded to 100 for increasing the power of the study. Therefore, the observations were made on 100 patients by including 50 patients in each group.

Table 1:

Variable	Group	No. of Patients	Mean	Std. Deviation	t value	p value
Age (years)	Group 1	50	35.8	9.9	0.472	0.691
	Group 2	50	34.8	9.7		
Weight (Kg)	Group 1	50	53.2	5.4	0.285	0.704
	Group 2	50	53.6	5.4		

3. Results

Table 1 shows the distribution of age of the patients included in the study. The mean age of patients included in both groups was comparable, for group 1 it was 35.8 ± 9.9 years and 34.8 ± 9.7 years. The table also shows mean weight of the patients included in the study. The mean weight of the patients in both groups was similar. The p value is 0.620 for age and 0.754 for weight respectively. So, there is no significant difference between two groups. Hence both groups were comparable.

Table 2 shows the sex distribution of the patients included in the study in both groups. In group 1; 34 were males & 10 were female and in group 2; 32 were males & 12 were female patients. The p value among two groups wrt to males and females was 0.613 and 0.730 respectively. So, no significant difference among two groups and were comparable.

Table 3 shows the onset characters of brachial plexus block. The mean onset time for sensory block in group 1 patients was observed as 19.8 with standard deviation of 1.3 minutes and for group 2 patients it was 17.0 and standard deviation of 0.8 minutes. We observed onset Mean time with Standard deviation was for motor block in group 1 and 2 was 22.3 ± 1.3 and 19.7 ± 0.9 minutes respectively. Above observations clearly shows that the onset of both sensory and motor block occurred earlier in patients who received dexmedetomidine along with ropivacaine and was found statistically significant between two groups.

Table 4 shows time of sensory and motor block in both groups. Duration of sensory and motor block in group 1 patients was 432.7 ± 39.5 and 344.3 ± 35.2 minutes respectively whereas the duration of sensory and motor block for the patients receiving dexmedetomidine 100 mcg (group 2 patients) was $896. \pm 146.4$ and 964.0 ± 153.9 minutes. This observation clearly establishes that the difference in duration of block served was more than those who did not received dexmedetomidine. The statistical analysis revealed these changes to be highly significant. ($P=0.000$)

Table 5 shows the duration of post-operative analgesia in both groups indicating that contemplated surgery could be finished without need for additional analgesic supplement as the minimum and maximum time for surgery were within the range of effective analgesia without movement of limb. The time for demand of dose of rescue analgesic by the patients in both groups was 493.6 ± 48.6 minutes

and 961.0 ± 141.6 minutes higher in patients who received dexmedetomidine and was found statistically significant ($P = 0.000$).

Table 6 shows the duration of surgery. In group 2 with dexmedetomidine the duration of surgery had a maximum duration of 210 min while without dexmedetomidine it was 140 mins. Hence this shows that with dexmedetomidine if required the surgery can be prolonged effectively.

Table 7 shows the number of rescue analgesics in first 24 hours in postoperative period. Whereas 23(52.2%) patients of group 1 (without Dexmedetomidine) needed 2 to 4 doses of injection of diclofenac sodium by intramuscular route to control pain but only 7(15.9%) patients of group 2 (with Dexmedetomidine) needed one rescue dose of diclofenac sodium for pain when VAS score was greater than 5.

4. Discussion

Managing postoperative pain has always been a challenge to the field of Anesthesia. Various studies done across the globe have suggested that post-surgical pain is one of the most common and most difficult to manage. Various drugs and methods have been tried and will continue to be tried until a patient satisfactory analgesia is achieved. Providing the patients with adequate postoperative pain relief is the need of the hour. In the current study, we have assessed the efficacy of Dexmedetomidine in post-operative analgesia.

The mean age of patients included in both groups was comparable i.e for non-intervention group 35.8 ± 9.9 years and for intervention group 34.8 ± 9.7 years. Samina Ismail et al.⁹ studied post-operative pain management after caesarean section in 120 patients with age group 23 to 31 years with 65.2 kg and 63.8 kg in pethidine (PCA) group and Pethidine (continuous iv drip) group respectively. In Mitsuhata H et al.¹⁰ the mean age was 35.8 yrs. in IV group and 38.1 yrs. in Epidural group. In Altindis NT et al.¹¹ study the mean age in Pethidine (Group I) was 58.1yrs & while 56.8yrs in group II (Dexmedetomidine). The average time for onset of sensory block in group 1 patients was observed as 19.8 with standard deviation of 1.3 minutes and for group 2 patients it was 17.0 and standard deviation of 0.8 minutes & similarly observed Mean time of onset with Standard deviation was for motor block in group 1 and 2 was 22.3 ± 1.3 and 19.7 ± 0.9 minutes respectively. The duration of sensory and motor block in group 1 patients without intervention was 432.7 ± 39.5 and 344.3 ± 35.2 minutes respectively whereas the duration of sensory and motor block for the patients

Table 2:

Sex	Group		Total	t value	p value
	Group 1	Group 2			
Female	12 (46.2%)	14 (53.8%)	26 (100%)	0.282	0.730
Male	37 (50%)	37 (50%)	74 (100%)	0.510	0.613
Total	50	50	100		
	50%	50%	100%		

Table 3:

Variables	Group	No. of Patients	Mean	Std. Deviation	T	P
Onset time of Sensory Block	Group 1	50	19.8	1.3	12.145	0.000
	Group 2	50	17.0	0.8		
Onset time Motor Block	Group 1	50	22.3	1.3	10.246	0.000
	Group 2	50	19.7	0.9		

Table 4:

Variables	Group	No. of Patients	Mean	Std. Deviation	T	P
Duration of effectiveness Sensory Block (min)	Group 1	50	432.7	39.5	20.294	0.000
	Group 2	50	896.8	146.4		
Duration of effectiveness Motor Block (min)	Group 1	50	344.3	35.2	26.036	0.000
	Group 2	50	964.0	153.9		

Table 5:

Variables	Group	No. of Patients	Mean	Std. Deviation	T	P
Time of first rescue analgesic (min)	Group 1	50	493.6	48.6	20.702	0.000
Post-operative analgesia	Group 2	50	961.0	141.6		

Table 6: Duration of surgery

Variables	Group	
Duration of Surgery	Group 1	Group 2
00-60	08	04
61-120	26	27
121-180	16	15
181-240	00	02
Total	50	50
	Group 1	Group 2
Surgery with minimum duration (min)	60	90
Surgery with maximum Duration (min)	140	210

Table 7: Dose requirement of rescue analgesics in 24 hours

Number of doses	Number of patients Group 1	Number of patients Group 2
1	21	07
2	11	00
3	08	00
4	04	00

receiving dexmedetomidine 100 mcg (group 2 patients) was $896. \pm 146.4$ and 964.0 ± 153.9 minutes. Addition of dexmedetomidine to ropivacaine has shown faster onset of sensory as well as motor block (17.0 ± 0.8 and 19.7 ± 0.9 minutes) as compared to ropivacaine (19.8 ± 1.3 and 22.3 ± 1.3 minutes) alone. Duration of motor block is also significantly prolonged. VAS scores decreased significantly in patients receiving dexmedetomidine with ropivacaine so also the demand of rescue dose of systemic analgesic. In both groups of patients remain hemodynamically stable, as compared to patients who received plain ropivacaine the heart rate and the blood pressure remains on the lower side for patients who received dexmedetomidine as an adjuvant to ropivacaine. Addition of dexmedetomidine to 0.5% ropivacaine causes mild sedation of the score 2 or 3 in which patient can respond to verbal commands

Zhang Y et al.¹² studied the effect of using different doses of dexmedetomidine and found that increasing the dose from 50 to 100 mcg with ropivacaine, the incidences of bradycardia and hypo/hypertension was noted. Similarly, study done by Fritsch G et al.¹³ noted occurrence bradycardia among the patients with Dexmedetomidine but blood pressure remained stable. Anjan Das et al.¹⁴ also reported bradycardia in their patients with Dexmedetomidine. Elyazed MMA & Mogahed MM¹⁵ compared dexmedetomidine with magnesium sulphate used along with ropivacaine and found higher incidence of intraoperative bradycardia and hypotension with Dexmedetomidine.

The study also observed and recorded the complications related to test drug and procedure in the present study we noted incidences of bradycardia and hypotension attributable to the central and peripheral action of dexmedetomidine. The incidence of procedure related complications like local hematoma, postoperative pneumothorax or inadvertent intravascular injection of local anesthetic and hemiparesis of diaphragm were nil.

5. Conclusion

To conclude, the addition of Dexmedetomidine 100 mcg to ropivacaine 0.5% solution for conduct of supraclavicular block improved the block quality and provided prolonged postoperative pain free period and decreased the demand of Systemic analgesics.

6. Conflict of Interest

None.

7. Source of Funding

None.

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