Section: Anaesthesiology

Original Research Article

SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB ORTHOPAEDIC SURGERIES: COMPARISON BETWEEN DEXMEDETOMIDINE AND CLONIDINE AS AN ADJUVANT TO ROPIVACAINE

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ABSTRACT

Background: Brachial plexus blockade is the cornerstone of regional anaesthesia practice of most anaesthesiologists. The supraclavicular approach is one of several techniques used to accomplish anaesthesia of the brachial plexus and is performed at the level of the brachial plexus trunks where almost entire sensory, motor and sympathetic nerve supply of the upper extremity is carried. Consequently, typical features of this block include its rapid onset, predictability and density. the objective is to compare dexmedetomidine and clonidine when added to a local anaesthetic solution for Supraclavicular brachial plexus block for upper limb orthopaedic surgeries with respect to Onset of sensory blockade, Onset of motor blockade, Duration of sensory blockade and Duration of motor blockade

Materials and Methods: The present Randomized Controlled Trial was carried out at Anaesthesia department involving patients to be posted for upper extremity orthopaedic surgeries in RK Damani Medical College SRIMS Chhatrapati Sambhajinagar, Maharashtra during the study period from January 2024 to December 2024.

Results: Proportion of females in Group C were 40% as compared with 22.2% in Group D. Proportion of males in Group C were 60% as compared with 77.8% in Group D. Sensory blockade onset was earlier in Group D as compared with Group C. Motor blockade onset was earlier in Group D as compared with Group C. Duration of sensory blockade was prolonged in Group D as compared with Group C. Duration of motor blockade was prolonged in Group D as compared with Group C.

Conclusion: Sensory and motor blockade onset was earlier in Group D as compared with Group C. Duration of sensory and motor blockade was prolonged in Group D as compared with Group C.

Keywords: Dexmedetomidine, clonidine, supraclavicular brachial plexus block for upper limb orthopaedic surgeries.

INTRODUCTION

Brachial plexus blockade is the cornerstone of regional anaesthesia practice of most anaesthesiologists. The supraclavicular approach is one of several techniques used to accomplish anaesthesia of the brachial plexus and is performed at the level of the brachial plexus trunks where almost entire sensory, motor and sympathetic nerve supply of the upper extremity is carried. Consequently, typical features of this block include its rapid onset, predictability and density.[1,2]

Long-acting local anaesthetics have advantage of longer duration of block and prolonged postoperative analgesia to help reduce postoperative analgesic requirement. Ropivacaine, one of the newer long-acting amide local anaesthetics, is the stereo isomer of bupivacaine and has been shown in to be less toxic than bupivacaine when injected intravenously.[3] The addition of an adjuvant to ropivacaine can further

have the advantage of prolonging the duration of block and postoperative analgesia as well as decrease the dose of ropivacaine required.[4]

Supraclavicular nerve block provides anaesthesia of the entire upper extremity in the most consistent and time-efficient manner.[5] Alpha-2 adrenergic receptor agonists have been the focus of interest for their sedative, analgesic, perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements.[6] The concurrent injection of α2 adrenergic agonist drugs has been suggested to improve the nerve block characteristic of local anaesthetic solutions through either local vasoconstriction and facilitation of C-fibre blockade or a spinal action caused by slow retrograde axonal transport or simple diffusion along the nerve.[6]

Objectives

The objectives of this study are to compare dexmedetomidine and clonidine when added to a local anaesthetic solution for Supraclavicular brachial plexus block for upper limb orthopaedic surgeries with respect to

1. Onset of sensory blockade
2. Onset of motor blockade
3. Duration of sensory blockade
4. Duration of motor blockade

MATERIALS AND METHODS

Study Setting: Department of Anaesthesiology, Tertiary care hospital

Study Population: All the patients to be posted for upper extremity orthopaedic surgeries in RK Damani Medical College SRIMS Chhatrapati Sambhajinagar, Maharashtra.

Study Period: January 2024 to December 2024

Study Design: RCT i.e. Randomized Controlled Trial

Sampling Technique: Simple random sampling

Inclusion Criteria

With ASA I and II physical status,

- Within the age group of 18 to 60 years of both sexes
- Undergoing upper limb orthopaedic surgeries
- Willing to participate in the study after informed written consent

Exclusion Criteria

ASA III and ASA IV

- Patient refusal
- Patient with coagulopathy or on anticoagulants
- Patient with central and peripheral neuropathy
- Local cutaneous infections
- Pregnant and lactating patients
- Patients with known hypersensitivity to study drugs.

Methods of data collection: After approval from ethical committee and written informed consent of patients, this study will be conducted in Tertiary care hospital. The patients with ASA (American Society of Anaesthesiologist) physical status I and II and between age group of 18-60 years of either sex, undergoing elective upper extremity orthopaedic surgeries, will be enrolled in this study. Patients will be randomly divided into two groups as odd & even according to their number while inclusion in the study. The two groups will be:

Group D: Dexmedetomidine 1µg/kg added to ropivacaine 0.5% (all odd no. patient) Group C: Clonidine 1µg/kg added to ropivacaine 0.5% (all even no. patient)

Preliminaries

- Written informed consent.
- Intravenous access with a 20 gauge I.V cannula on the contralateral upper limb under aseptic techniques.

Equipments

a) For the procedure:

A portable tray covered with sterile towels containing:

- Sterile syringes - one 20ml and one 10ml.
- Hypodermic needles of 5 cm length, 22 G.
- Bowl containing Povidone iodine and spirit.
- Sponge holding forceps.
- Towels and towel clips.
- Sterile gauze pieces.

b) For emergency resuscitation:

- The anaesthesia machine, emergency oxygen source (E type cylinders), pipeline O2 supply, working laryngoscopes, appropriate size endotracheal tubes and connectors.
- Working suction apparatus with suction catheter.
- Oropharyngeal airways.
- Intravenous fluids.
- Drugs: Thiopentone, Diazepam, Succinylcholine, Hydrocortisone, Atropine, Adrenaline, Aminophylline, Mephenteramine, Calcium gluconate and Sodium bicarbonate.

c) Monitors:

- Pulse oximeter.
- Noninvasive blood pressure monitors by sphygmomanometer on the opposite upper limb.

Patient lies supine, arms by the side and head turned slightly to the other side. The interscalene groove and mid-point of clavicle would be identified. After aseptic preparation of area, at a point 1.5 to 2.0cm posterior and cephalad to mid-point of clavicle, subclavian artery pulsations are felt. A skin wheel is raised with local anaesthetic just cephalo-posterior to the pulsations.

Next, a 22-gauge, 5 cm needle, mounted on a 20 ml syringe, would be passed through the same point, parallel to the head and neck, in a caudad, slightly medial and posterior direction, until either paraesthesia was elicited or first rib was encountered. If the first rib is encountered, the needle would be moved over the first rib until a paranesthesia was elicited either in the hand or arm.

After eliciting paranesthesia and negative aspiration of blood, the study medication would be injected.

All patients would be monitored for anaesthesia and analgesia upto 24 hours post-operatively.

Sensory block was evaluated by temperature testing using spirit-soaked cotton on skin dermatomes C4 to

T2 whereas motor block was assessed by asking the patient to adduct the shoulder and flex the forearm against gravity.

Patients on adrenoreceptor agonist or antagonist therapy, with known hypersensitivity to local anaesthetic drugs, bleeding disorders, uncontrolled diabetes mellitus, pregnant women and pre-existing peripheral neuropathy, will be excluded from the study.

Thorough preoperative evaluation will be done and all the routine investigations will be carried out. Patients will be kept NBM 6-8 hours before surgery. Informed written consent will be obtained from all patients after detail explanation of the procedure to be performed. Patients will be premedicated with intravenous ranitidine 0.25 mg/kg, ondensetron 0.1mg/kg in preoperative room. On arrival in the operation theater, monitors will be attached (heart rate, NIBP, oxygen saturation, ECG) and baseline vital parameters like heart rate, systolic and diastolic blood pressure, and oxygen saturation will be recorded.

An intravenous line will be secured in the unaffected limb and Ringer's lactate solution will be started. All the patients will receive brachial plexus block through the supraclavicular approach by an experienced anaesthesiologist different from the assessor.

Both will be blinded to the treatment groups. Neural localization will be achieved by nerve locator and with a 22 G, 50-mm-long (Stimuplex) needle following negative aspiration, 20 mL of a solution of 0.5% ropivacaine which is a local anaesthetic agent combined with dexmedetomidine or clonidine as mentioned above will be injected.

A 3-min massage will be performed to facilitate an even drug distribution. Sensory blocks will be assessed by the pin prick method. Assessment of sensory block will be done at each minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade is

achieved. Sensory onset will be considered when there will be dull sensation to pin prick along the distribution of any of the abovementioned nerves.

Statistical analysis and methods: Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions. Association between two qualitative variables was seen by using Chi square/ Fischer's exact test. Comparison of mean and SD between two groups will be done by using unpaired t test to assess whether the mean difference between groups is significant or not.

RESULTS

We included 45 patients in each group namely Group C (Clonidine) and Group D (Dexmeditomedine) in our study. Out of 45 patients from Group C, majority were from 31-40 years i.e. 12(26.7%) followed by 10(22.2%) from 41-50 years, 9(20%) from 51-60 years age group. Out of 45 patients from Group D, majority were from 31-40 years i.e. 19(42.2%) followed by 13 (28.9%) from 21-30 years, 6(13.3%) from 41-50 years age group.

Proportion of females in Group C were 40% as compared with 22.2% in Group D. Proportion of males in Group C were 60% as compared with 77.8% in Group D.

Table 1: Distribution according to age and gender.

		Group C		Group D	
		Frequency	Percent	Frequency	Percent
Age group in years	< 20	4	8.9	1	2.2
	21-30	8	17.8	13	28.9
	31-40	12	26.7	19	42.2
	41-50	10	22.2	6	13.3
	51-60	9	20	4	8.9
	> 60	2	4.4	2	4.4
	Total	45	100	45	100
Gender	Female	18	40	10	22.2
	Male	27	60	35	77.8
	Total	45	100	45	100

Table 2: Comparison of onset of sensory blockade between Group C and Group D

Group		N	Mean	Std. Deviation	t	p	Inference
Sensory block onset	Group C	45	11.26	1.09	9.551	0.0001	Highly significant
	Group D	45	8.74	1.38		(<0.01)	

Mean duration of sensory blockade onset in Group C was 11.26±1.09 minutes and that of Group D was 8.74±1.38 minutes. When we compared the mean duration of sensory blockade onset between two groups, the difference was found to be statistically significant ($p<0.05$). It means sensory blockade onset was earlier in Group D as compared with Group C.

Table 3: Comparison of onset of motor blockade between Group C and Group D

Group		N	Mean	Std. Deviation	t	p	Inference
	Group C	45	11.89	13.30	4.69	0.04	Significant

Motor block onset	Group D	45	8.52	1.18		(<0.05)	

Mean duration of motor blockade onset in Group C was 11.89±13.30 minutes and that of Group D was 8.52±1.18 minutes. When we compared the mean duration of motor blockade onset between two groups, the difference was found to be statistically significant (p<0.05). It means motor blockade onset was earlier in Group D as compared with Group C.

Table 4: Comparison of duration of sensory blockade between Group C and Group D

Group		N	Mean	Std. Deviation	t	p	Inference
Sensory block duration	Group C	45	339.78	34.54	-16.975	0.0001	Highly significant
	Group D	45	468.89	37.55		(<0.01)	

Mean duration of sensory blockade in Group C was 339.78±34.54 minutes and that of Group D was 468.89±37.55 minutes. When we compared the mean duration of sensory blockade between two groups, the difference was found to be statistically significant (p<0.05). It means duration of sensory blockade was prolonged in Group D as compared with Group C.

Table 5: Comparison of duration of motor blockade between Group C and Group D

Group		N	Mean	Std. Deviation	t	p	Inference
Motor block duration	Group C	45	312.67	30.26	-15.546	0.0001	Highly significant
	Group D	45	414.89	32.10		(<0.01)	

Mean duration of motor blockade in Group C was 312.67±30.26 minutes and that of Group D was 414.89±32.10 minutes. When we compared the mean duration of motor blockade between two groups, the difference was found to be statistically significant (p<0.05). It means duration of motor blockade was prolonged in Group D as compared with Group C.

DISCUSSION

Demographic information

We included 45 patients in each group namely Group C (Clonidine) and Group D (Dexmeditomedine) in our study. Out of 45 patients from Group C, majority were from 31-40 years i.e. 12(26.7%) followed by 10(22.2%) from 41-50 years, 9(20%) from 51-60 years age group. Out of 45 patients from Group D, majority were from 31-40 years i.e. 19(42.2%) followed by 13 (28.9%) from 21-30 years, 6(13.3%) from 41-50 years age group. Mean age of patients from Group C was 40.04±13.34 years and that of Group D was 37.24±10.93 years. When we compared the mean age between two groups, the difference was found to be statistically not significant (p>0.05). Proportion of females in Group C were 40% as compared with 22.2% in Group D. Proportion of males in Group C were 60% as compared with 77.8% in Group D.

Chaudhary UK et al,[7] reported mean age of patients from Group C was 35.06±12.61 years and that of Group D was 36.26±12.36 years and the difference was found to be statistically not significant (p>0.05). Chaudhary UK et al,[7] reported proportion of females in Group C were 10.5% as compared with 5% in Group D. Proportion of males in Group C were 89.5% as compared with 95% in Group D. Nazir O et al,[8] reported mean age in clonidine group as 45.64 ±8.91years and in Dexmed group as 46.44 ± 9.29 years which is slightly higher as compared with our study findings.

Onset of sensory and motor blockade: Mean duration of sensory blockade onset in Group C was 11.26±1.09 minutes and that of Group D was 8.74±1.38 minutes. When we compared the mean duration of sensory blockade onset between two groups, the difference was found to be statistically significant (p<0.05). It means sensory blockade onset was earlier in Group D as compared with Group C.

Mean duration of motor blockade onset in Group C was 11.89±13.30 minutes and that of Group D was 8.52±1.18 minutes. When we compared the mean duration of motor blockade onset between two groups, the difference was found to be statistically significant (p<0.05). It means motor blockade onset was earlier in Group D as compared with Group C.

Kirubahar R et al,[9] in his study reported that the mean time for onset of sensory block in Group D was 4.7 minutes which was lower than Group C -8.47 minutes. This was statistically significant (p<0.001) The mean time for onset of motor block in Group D was 9.63 minutes which was lower than Group C-13.1minutes. This was statistically significant (p<0.05). These findings were relatively lowed as compared with our findings though both studies proved that Group D is better in sensory and motor blockade onset. Hosalli V. et al,[10] also reported that mean duration of sensory blockade onset in Group C was 8.07±0.65 minutes and that of Group D was 8.14±1.07 minutes. They also reported that mean duration of motor blockade onset in Group C was 14.62±2.07 minutes and that of Group D was 14.93±1.84 minutes.

Duration of sensory blockade: Mean duration of sensory blockade in Group C was 339.78±34.54 minutes and that of Group D was 468.89±37.55 minutes. When we compared the mean duration of sensory blockade between two groups, the difference was found to be statistically significant (p<0.05). It

means duration of sensory blockade was prolonged in Group D as compared with Group C. The block was significantly prolonged in dexmedetomidine group as compared to clonidine group.

Chaudhary UK et alm,[7] reported that the duration of sensory blockade was (644.40±162.47 minutes) in dexmedetomidine group, (445.76±137.92 minutes) in clonidine group and the difference being statistically significant (p< 0.001) which is slightly higher than our study findings. Tripathi A et al,[11] in 2016 compared clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block and reported that the duration of sensory blockade in Group C was 316.67±45.21 minutes and that of Group D was 502.67±43.78 minutes (p<0.05) that is matching with our findings.

Duration of motor blockade

Mean duration of motor blockade in Group C was 312.67±30.26 minutes and that of Group D was 414.89±32.10 minutes. When we compared the mean duration of motor blockade between two groups, the difference was found to be statistically significant (p<0.05). It means duration of motor blockade was prolonged in Group D as compared with Group C

Chaudhary UK et al,[7] reported that the duration of motor blockade was (597.05±150.84 minutes) in dexmedetomidine group, (405.47±134.05 minutes) in clonidine group and the difference being statistically significant (p< 0.001) which is slightly higher than our study findings. Tripathi A et al,[11] in 2016 compared clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block and reported that the duration of motor blockade in Group C was 372.67±44.48 minutes and that of Group D was 557.67±38.83 minutes which is almost similar to our study findings.

CONCLUSION

Sensory and motor blockade onset was earlier in Group D as compared with Group C.

Duration of sensory and motor blockade was prolonged in Group D as compared with Group C.

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