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Research Article

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COMPARISON OF ROPIVACAINE 0.5% WITH DEXMEDETOMIDINE AND CLONIDINE AS ADJUVANTS IN ULTRASOUND-GUIDED INFRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERY

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Brachial plexus block, Infraclavicular block, Ropivacaine, adjuvants like dexmedetomidine and clonidine

ABSTRACT

Background: The Institutional Ethics Committee and patients' informed written consent were obtained before this study was carried out in the Department of Anaesthesiology at Sardar Patel Medical College in Bikaner, Rajasthan. An established method for delivering anaesthesia and analgesia during upper limb surgery is brachial plexus block. For peripheral nerve blocks, ropivacaine, a long-acting amide with a safe cardiac profile, is chosen. It has been proven that different adjuncts may be added to LA solutions to boost their effectiveness and longevity while lowering the overall dose of LA utilised and minimising any systemic side effects. Our goal was to assess the effectiveness of adjuvants such as dexmedetomidine and clonidine in comparison to 0.5% ropivacaine in an infraclavicular block for upper limb surgery under USG guidance. **Method:** Fifty adult patients planned for elective upperlimb surgery with an infraclavicular brachial plexus block under USG guidance were included. All research participants were split into two groups at random. In groups D and C, respectively, dexmedetomidine and clonidine were used as adjuvants with 0.5% ropivacaine. Our main goal was to compare the postoperative analgesic duration in both research groups, as well as the onset and duration of sensory and motor block. Patients were monitored for any complications connected to the medicine and procedure while hemodynamic indicators were also compared. **Results:** Group D's sensory and motor block action initiation time was substantially quicker than that of group C's (p 0.001). When compared to Group C, Group D's sensory and motor block and postoperative analgesia durations were considerably longer (p value 0.001). **Conclusion:** Dexmedetomidine is a more effective adjuvant than clonidine when given during upper limb surgery with an infraclavicular block that is guided by a USG.

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INTRODUCTION

Brachial plexus block (BPB) is a well-accepted technique to provide anesthesia and analgesia [1]. Upper limb (distal arm, elbow, wrist, and hand) surgery is often performed under brachial plexus block (BPB), which is a series of regional anesthesia techniques and also contributes to reliable postoperative analgesia [2]. Both the axillary and musculocutaneous nerves are affected/ blocked at the level of the cords before they branch from the brachial plexus sheath [3]. In contrast to interscalene and supraclavicular brachial plexus blockade, an infraclavicular block has the advantage of minimal risk to intravertebral, intrathecal, or epidural injection, as well as reduced incidence of phrenic nerve paralysis or stellate ganglion block. However, an ICB has a small risk of pneumothorax, hematoma, and nerve injury [3]. Thus, infraclavicular BPB with coracoid approach has gained popularity because of its consistent bony landmarks, less chances of vascular puncture, pneumothorax and adequate neural blockade.

Recently, the use of USG guidance for exact localization of nerve plexus has revolutionized the technique of regional anaesthesia. It has improved the success rate as well as safety along with marked reduction of the dose of local anaesthetics. Hence, we decided to compare the efficacy of adjuvants like clonidine and dexmedetomidine with ropivacaine in USG guided infraclavicular block for upper limb surge. The aim of the study is to compare the efficacy of 0.5% Ropivacaine with Dexmedetomidine 1µg/Kg and Clonidine 1µg/kg as adjuvants in USG guided Infraclavicular Brachial Plexus Block for upper limb surgery. The primary objective of the study is to check Onset of sensory and motor block, Duration and Quality of sensory and motor block, Duration of Post operative Analgesia and the secondary objectives are to know Hemodynamic variables and sedation score, and side effects and complications related to drugs and technique.

MATERIALS AND METHODS

This study was conducted in the Department of Anaesthesiology, Sardar Patel Medical College, Bikaner, Rajasthan after obtaining approval from Institutional Ethics Committee & informed written consent from patients

Study design: Prospective randomized double blind comparative study.

Study population: All Cases Posted for elective upper limb surgery.

Inclusion Criteria: Adult patients of ASA-I and II; Upper limb surgery; Age 18-65 years

Exclusion Criteria: Patient's Refusal; Patients with history of bleeding disorders; Patients on anticoagulant therapy; Patients with local infection; Patients with known allergy to local anaesthetic drugs; Psychiatric illness; Patients with cardiac pulmonary, hepatic, renal, psychiatric, metabolic and cardiac diseases

Sampling procedure: We used systematic sampling. We used double blinding technique

Sample size and sampling technique: 50 patients were randomly assigned to two groups for USG guided infraclavicular brachial plexus block

Groups	Drugs	Total volume Drug	No. of Patients
Group D	Injection 0.5% Ropivacaine (29ml) with dexmedetomidine 1 µg/kg (1ml)	30ml	25
Group C	Injection 0.5% Ropivacaine 29ml with clonidine 1µg/kg (1ml)	30ml	25

The anaesthetic procedure was explained to every patient and their attendants in the local tongue, and an informed written permission was acquired. Depending on whether the patient was assigned to Group D (0.5% ropivacaine 29ml with 1 ml of dexmedetomidine (1g/kg) or Group C (0.5% ropivacaine 29ml with 1ml of clonidine (1g/kg), the needle was fixed in place and the appropriate drug was injected after negative aspiration to avoid intravascular injection.

Pinpricking skin dermatomes supplied by C5-T2 once every two minutes until the sensory block's beginning was used to measure the block's start time. In the first 30 minutes following medication injection, the same observer evaluated the onset of motor block every 5 minutes and then instructed the surgeons to carry out the intended procedure. If a sensory/motor block was not accomplished even after 30 minutes, the block was deemed to have failed and was changed to general anaesthesia.

Parameters to be monitored

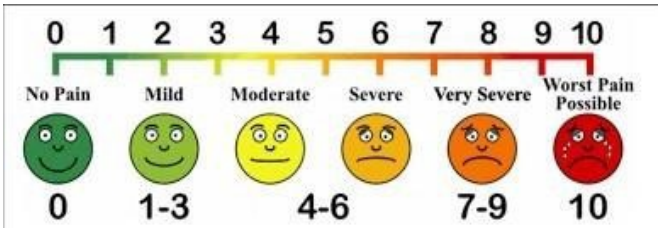
- Onset and duration of sensory block by pinprick method
- Onset and duration of motor block by Modified Bromage 3-point score

- Hemo dynamic variables (Heart rate, Blood pressure and SPO_2)
- Duration of analgesia using VAS Score
- Level of sedation using Ramsay Sedation Scale
- Patients' satisfaction score as excellent, good, fair, poor

Postoperative observations

Duration of sensory blockade was observed. 't' is the time of onset of sensory blockade till the patient complains of pain at the site of surgery. Rescue analgesic was given after that only. Pain at the site of surgery was assessed by Visual Analogue Score (VAS) for every hour till first 6 hours then every 2 hourly for 12 hours then 3 hourly later on.

VAS score



Duration of Motor blockade observed

It is the period of time between the commencement of a motor block to the point at which all motor function has returned. Intraoperative hemodynamic parameters were recorded at 0, 5, 10, 15, 30, 45, 1st and 2nd hours, and then every 2 hours for the next 6 hours and then every 12 hours for the next 24 hours. Following surgery, all patients got a standard intramuscular injection of the painkiller Diclofenac 75mg when they began to experience pain (VAS > 3). The first dosage of rescue analgesic administered in the postoperative period and the total number of doses administered in the first 24 hours were recorded. Any unfavourable incidents, such as nausea, vomiting, respiratory depression, bradycardia or hypotension, pruritus, or any allergic responses to study medicines, were reported as complications or side effects.

Data Analysis

All of the selected instances' information was gathered and entered into a master chart. Data analysis was carried out using SPSS 16 and a PC. This programme was used to determine the range, frequencies, percentage means, standard deviation, chi square, and p-value as well as to evaluate the significance of differences between quantitative variables. A significant association was defined as one with a 'p-value' of less than 0.05.

RESULTS

This prospective study was conducted at Sardar Patel Medical College, Bikaner. All the data were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 26. Duration of sensory and motor block, and hemodynamics parameters were subjected to independent t-test for statistical analysis. P-value<0.05 was considered as statistically significant and P < 0.001 as highly significant. In our study we included a total of 50 patients, 25 received. Ropivacaine and dexmedetomidine (D group) as anesthetic agents and 25 who received Ropivacaine and clonidine (C group) as anesthetic agents.

Age Distribution

Table 2: Age related characteristics of cases in study groups

Group	No. of Cases	Age				p-value
		Min Age	Max Age	Mean	SD	
Group C	25	18	52	31.04	8.3	0.068
Group D	25	20	62	36.08	10.6	(NS)

Mean heart rates for groups C and D in the current study are 75.22 and 11.5 respectively, and 75.12 and 8.65 respectively. Due to the fact that the difference in heart rate was not determined to be statistically significant (p-value = 0.47), both clonidine and dexmedetomidine had an equivalent impact on heart rate. The mean systolic blood pressure in group C in the current study was 121.248.53 and the mean diastolic blood pressure was 74.196.15, whereas the mean systolic blood pressure in group D was 120.038.73 and the mean diastolic blood pressure was 72.746.92. Since the difference between the systolic and diastolic blood pressures was not determined to be statistically significant (p-values of 0.62 and 0.41, respectively), clonidine and dexmedetomidine have comparable effects on blood pressure.

In the current study, group C's mean arterial pressure is 89.37 6.92 whereas group D's is 88.78 6.70. Since there was no statistically significant difference in mean arterial pressure (p-value = 0.761), Clonidine and Dexmedetomidine have comparable effects on mean arterial pressure.

In the current study, the mean Ramsay Sedation Scores for patients in group C were 1.62 0.27 and 2.15 0.23, respectively. It was determined that the difference in the Ramsay Sedation Score was statistically extremely significant (p-value 0.001).

Dexmedetomidine performs significantly better than Clonidine in our investigation, as evidenced by the fact that the mean RSS in Group D patients is greater than that in Group C patients.

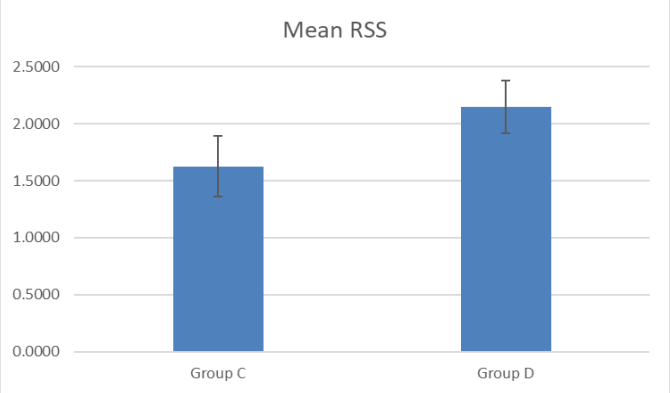


Fig. 1: Comparison of Mean Ramsay Sedation Scores of patients in Group C and Group D

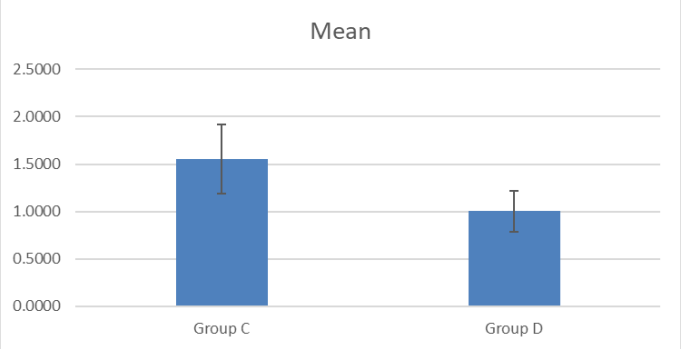


Fig. 2: Comparison of Mean Visual analog scale Scores of patients in Group C and Group D

In the present study mean Visual analog scale (VAS) Scores of patients in group C is 1.55±0.36 whereas in group D is 1.01±0.21. The difference of Visual analog scale (VAS) Score was found to be statistically highly significant (p-value < 0.001). The mean Group D patients had much better post operative pain profile as compared to that of Group C patients.

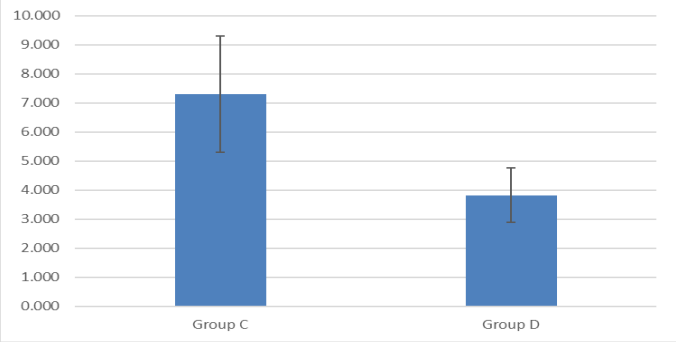


Fig. 3: Comparison of Mean time to Onset of action of Sensory Block of patients in Group C and Group D

Onset of sensory blockade is the time interval between administration of (Ropivacaine+Clonidine (Group C) or Ropivacaine + Dexmedetomidine (Group D) and absence of sensation to pin prick (VAS≤3). In the present study mean time to Onset of action of Sensory Block of patients in group C is 7.30±2.0 whereas in group D is 3.82±0.93. The difference of time to Onset of action of Sensory Block was found to be statistically highly significant (p-value < 0.001). The Group D patients who were given Dexmedetomidine had quicker onset of sensory block as compared to that of Group C patients.

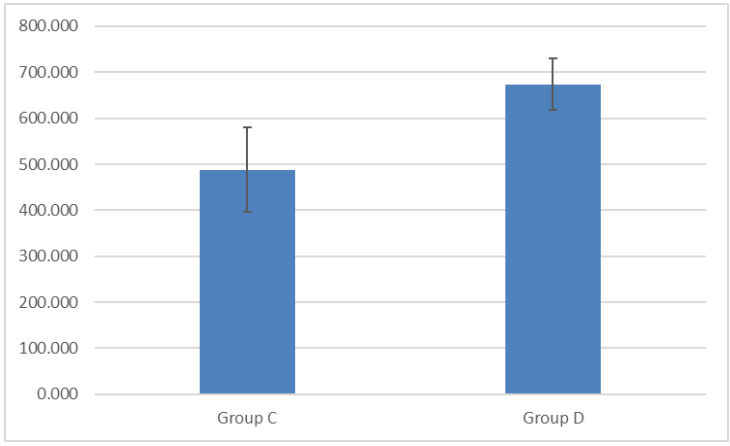


Fig. 4: Comparison of Mean Duration of action of Sensory Block of patients in Group C and Group

Duration of sensory blockade recorded as time interval between onset of complete sensory block and the onset of pain in the post operative period. In the present study mean duration of action of Sensory Block of patients in group C is 487.51±91.67 minutes whereas in group D it is 673.86±56.73. The difference of mean duration of action of sensory Block was found to be statistically highly significant (p-value < 0.001). This mean Group D patients who were given Dexmedetomidine had significantly longer duration of sensory block as compared to that of Group C patients.

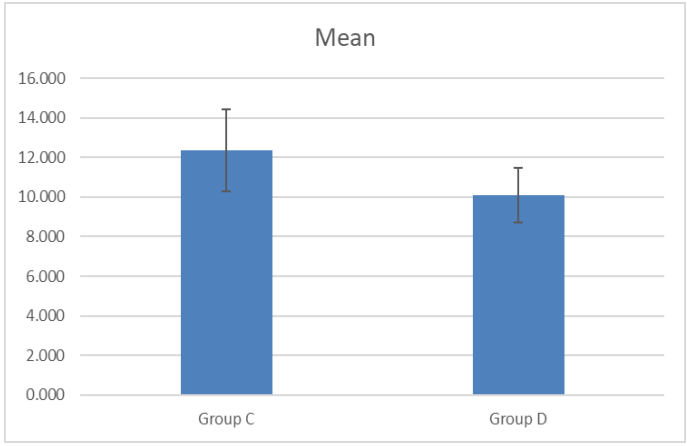


Fig. 5: Comparison of Mean time to Onset of action of Motor Block of patients in Group C and Group D

Onset of motor blockade is the time interval between administration of test drug, (Ropivacaine + Clonidine (Group C) or Ropivacaine + Dexmedetomidine (Group D) and complete loss of muscle function. In the present study mean time to Onset of action of Motor Block of patients in group C is 12.352±2.078 whereas in group D is 10.100±1.363. The difference of time to Onset of action of motor Block was found to be statistically highly significant (p-value < 0.001). The mean Group D patients who were given Dexmedetomidine had quicker onset of motor block as compared to that of Group C patients.

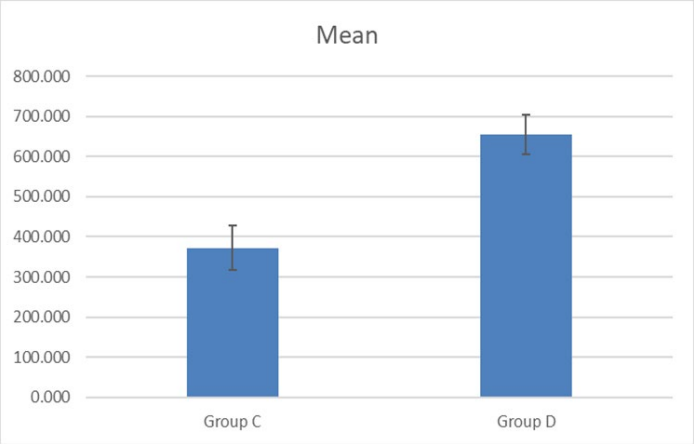


Fig. 6: Comparison of Mean Duration of action of Motor Block of patients in Group C and Group D

Duration of motor bloc is the time interval between onset of complete motor block and the recovery of normal muscle power. In the present study mean duration of action of Motor Block of patients in group C is 372.52 ± 55.31 minutes whereas in group D it is 654.98 ± 50.11. The difference of mean duration of action of Sensory Block was found to be statistically highly significant (p-value<0.001). This Group D patients who were given Dexmedetomidine had significantly longer duration of motor block as compared to that of Group C patients.

Table 3: Comparison of need of rescue analgesia (in first 24 hours) in group C and group D

Group	No of rescue analgesics (Given in first 24 hours)				χ^2	p - Value
	0	**1**	**2**	**3**		
Group C	0	0	23	2	42.64	< 0.001
Group D	1	22	2	0		

Rescue analgesia was given to the patients when they complained of pain during the surgery and was recorded as a need to provide analgesia in first 24 hrs. The number of rescue analgesics required by patients in both groups were recorded.

In Group C, 23 patients needed 2 rescue analgesia and 2 patients needed 3 rescue analgesia during the first 24 hours post operatively whereas in Group D, 22 patients needed 1 rescue analgesia 2 patients needed 2 rescue analgesia and 1 patient did not need any rescue analgesia. The difference in the need of rescue analgesia between the two groups Group C and Group D is statistically highly significant (p-value <0.001). The observation suggests that patients who were given Ropivacaine + Dexmedetomidine needed much less rescue analgesia as compared to the group who received Ropivacaine + Clonidine.

Side Effects

Hemodynamic parameters remained stable throughout the surgery and post operatively. Bradycardia observed in few patients, but HR not gone below 60 and did not require any intervention. Adverse effects like hypotension, nausea, vomiting, respiratory depression, and desaturation were not observed in any patient of either group during the post operative period.

DISCUSSION

This prospective study was done to evaluate the onset of sensory block, onset of motor blockade, duration of sensory and motor blockade, duration of analgesia and time for rescue analgesia and side effects of dexmedetomidine with ropivacaine (Group D) vs clonidine with ropivacaine (Group C) given by ultrasound guided infraclavicular brachial plexus block approach for elective upper limb forearm and hand surgeries. The onset of sensory and motor block assessed by pin prick and VAS score respectively. The time of first rescue analgesics were assessed in the study. Hemodynamic parameters noted are mean arterial blood pressure, pulse rate, and oxygen saturation. Postoperative pain is assessed using visual analogue scale. If VAS >3 rescue analgesics is administered.

In the present study, in Group C, all 25 patients were males whereas in Group D 24 patients were males and 1 patient was female. Mean age in group C is 31.04±8.3 years and mean age in group D is 36.08±10.6 years. The maximum number of patients was in the third decade of life with 21 (42%) cases followed by fourth decade with 16 (32%) cases. The minimum number of cases was in the seventh decade with only 1 case. There was decrease in heart rate after administration of drug in

both groups. Bradycardia was more in Group D as compared to Group C, however the change in heart rate in both groups was not found statistically significant.

The mean base line systolic and diastolic blood pressure of patient in Group C was 133/80 mm Hg and Group D was 131/78 mm Hg. There was decrease in both systolic and diastolic blood pressure after administration of drug in both groups. The decrease in blood pressure was more in Group D as compared to Group C, however the change in blood pressure in both groups was not found statistically significant. The baseline mean arterial pressure in Group C and Group D was 91 (mmHg). We observed that there is decrease in MAP after administration of drug in both groups. The decrease in MAP was more in Group D as compared to Group C, however the change in MAP in both groups was not found statistically significant.

The mean respiratory rate in group C was 12.54±0.48 whereas respiratory rate in group D was 12.43±0.31. The difference of mean respiratory rate was not found statistically significant (p-value = 0.33), that means that both clonidine and Dexmedetomidine have similar effect on respiratory rate. The mean oxygen saturation (%) in group C is 98.82±0.53 whereas mean arterial pressure in group D is 98.53±0.57. The difference of mean oxygen saturation was not found statistically significant (p-value = 0.07), that means that both clonidine and Dexmedetomidine has similar effect on change in oxygen saturation.

On comparing Ramsay Seadation Scores, it shows that for most of the time during the surgery from 15 minutes after the anesthesia Dexmedetomidine group patients had much better Sedation scores as compared to Clonidine group and Dexmedetomidine provides better anesthesia. On comparing VAS scores in both groups, it shows that for most of the patients who received Dexmedetomidine felt less pain as compared to patients who received Clonidine.

The mean time to Onset of Sensory Block (min) of patients in group C is 7.30±2.0 whereas in group D is 3.82±0.93. The difference of time to Onset of action of Sensory Block was found to be statistically highly significant (p-value < 0.001). The mean Group D patients who were given Dexmedetomidine had quicker onset of sensory block as compared to that of Group C patients. The mean duration of Sensory Block (min) of patients in group C is 487.51±91.67 minutes whereas in group D it is 673.86±56.73. The difference of mean duration of action of Sensory Block was found to be statistically highly significant (p-value < 0.001). This mean Group D patients who were given Dexmedetomidine had significantly longer duration of sensory block as compared to that of Group C patients. The mean time to Onset of Motor Block (min) of patients in group C is 12.352±2.078 whereas in group D is 10.100±1.363. The difference of time to Onset of action of motor Block was found to be statistically highly significant (p-value < 0.001). The mean Group D patients who were given Dexmedetomidine had quicker onset of motor block as compared to that of Group C patients. The mean duration of Motor Block (min) of patients in group C is 372.52±55.31 minutes whereas in group D it is 654.98±50.11.

The difference of mean duration of action of motor Block was found to be statistically highly significant (p-value < 0.001). This mean Group D patients who were given Dexmedetomidine had significantly longer duration of motor block as compared to that of Group C patients. In Group C, 23 patients needed 2 rescue analgesia and 2 patients needed 3 rescue analgesia in the first 24 hrs post operatively whereas in Group D, 22 patients needed 1 rescue analgesia 2 patients needed 2 rescue analgesia and 1 patient did not need any rescue analgesia. The difference in the need of rescue analgesia between the two groups Group C and Group D is statistically highly significant (p-value <0.001). The observation suggests that patients who were given Ropivacaine + Dexmedetomidine needed much less rescue analgesia as compared to group received Ropivacaine + Clonidine.

CONCLUSION

When used with ropivacaine in an ultrasound-guided brachial plexus block, we examined the effectiveness of clonidine and dexmedetomidine as adjuvants. When used as an adjuvant instead of clonidine, dexmedetomidine results in a longer duration of post-operative analgesia. When compared to clonidine, dexmedetomidine has the advantage of a faster onset of the sensory and motor block. It was determined that the creation of intra-operative sedation and adverse effects were equivalent between clonidine and dexmedetomidine. When added to ropivacaine as an adjuvant for ICBP block, dexmedetomidine may be preferable to clonidine.

FINANCIAL ASSISTANCE

Nil

CONFLICT OF INTEREST

The authors declare no conflict of interest

AUTHOR CONTRIBUTION

Rakesh Sharma contributed in conceptualizing, data curating and formal analysis. He also contributed in writing original draft. Kiwi Mantan contributed in investigation and supervision of whole study. Sandeep Kothari contributed in writing, reviewing and editing the manuscript. T. Agalya and Neha contributed in accessing resources and reviewing and editing the manuscript. All authors read and approved the manuscript.

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