

EFFECTS OF DIFFERENT DOSES OF DEXMEDETOMIDINE ON CONTROLLED HYPOTENSION DURING MIDDLE EAR SURGERY

Ravisankar Vudayagiri¹, Subba Rao Paritala², Satyanarayana Dasari³, Sravani Asadi⁴

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Corresponding Author:
Dr. Sravani Asadi,
Email: mkreddydoctor@gmail.com

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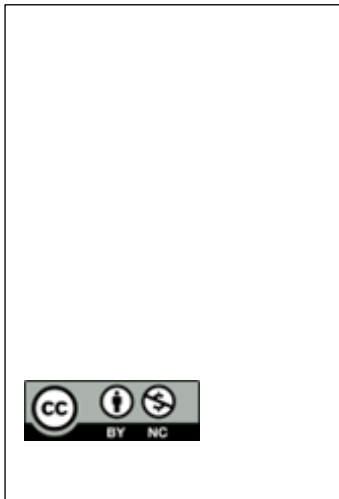
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^{1,2,3}Associate Professors, Department of Anaesthesiology, A.C.S.R. Govt Medical College, Nellore, Dr. Y. S. R. University of Health Sciences, Andhra Pradesh, India.

⁴Senior Resident, Department of Anaesthesiology A.C.S.R. Govt Medical College, Nellore, Dr. Y.S.R University of Health Sciences, Andhra Pradesh, India.

Abstract

Introduction: A bleeding-free surgical field is crucial for middle ear surgery. Impairment of intraoperative visibility due to bleeding is a problem in ear procedures. As a result, controlled hypotension helped to reduce intraoperative bleeding. Controlled hypotension is stated as “reduction in systolic blood pressure to 80 - 90 mmHg, a reduction of mean arterial pressure to 50 - 65 mmHg or a reduction of 30% of baseline mean arterial pressure” In middle ear procedures the main techniques to reduce blood loss were mild head end elevation of 15°, and topical application or infiltration of adrenaline (1: 50,000 and 1: 200,000). A mild head end elevation acts by reducing the venous and arterial pressures in head and neck but in turn increases the chance of air embolism. In case of such hypotension, head end elevation would furthermore compromise vascular supply to head and neck. Out of the several drugs, dexmedetomidine has emerged as one among the most commonly used drugs in anesthetic field, along with routinely used anesthetic drugs. Dexmedetomidine, a highly selective α_2 adreno-receptor agonist mediating analgesia and sedation.⁶ Dexmedetomidine is utilised as an adjunct to general anaesthesia in the preoperative (sedation), intraoperative (analgesia and hemodynamic stability), and postoperative (recovery) phases (no respiratory depression). Major side effects noted following the infusion of dexmedetomidine are hypotension and bradycardia. The elimination half-life of dexmedetomidine is 2 hours and its redistribution half-life is 6 mins, and this short life makes it a ideal drug for intravenous infusions. Hence a study was conducted to assess the effects of dexmedetomidine in lower doses on, hemodynamic parameters like heart rate and blood pressure, bleeding in surgical field. **Materials & Methods:** A randomized prospective study was conducted after the prior approval by the institutional ethical committee at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh during the period of November 2019 to October 2021. The sample size at 95% confidence interval with standard deviation of heart rate with conventional procedure at 12.8 beats per minute.¹⁰ and expected difference of heart rate of 10 beats per minute was estimated to be 30 per each group. Subjects belonging to American Society of Anaesthesiologists (ASA) physical status I and II of both genders, aged 18-60 years, weighing more than 45 kgs, posted for elective middle ear surgery were enrolled for the study. Patients suffering from cardio vascular diseases, hypovolemia, bradycardia, hepatic impairment, diabetes mellitus, mothers who are pregnant and lactating, patients who are on sedatives and hypnotics and patients with dexmedetomidine allergy were excluded. All patients were evaluated one day prior to surgery, during pre-operative evaluation and informed consent was taken. The quality of hypotensive anaesthesia was determined by the operating surgeon based on the blood loss at surgical site. Grade 0 is no bleed, excellent surgical condition, no suction needed. Grade 1 is minimal bleed, sporadic suction needed. Grade 2 is diffuse bleed, needed repeated suction. Grade 3 is bleed is troublesome, needed continuous suction. The neuromuscular blockade was reversed with injections of 0.05 mg/kg neostigmine and 0.008 mg/kg glycopyrrolate at end of surgery. After adequate



spontaneous breathing efforts and motor recovery, the patient was extubated. Patient later transferred to PACU to be observed for respiratory depression, sedation score, haemodynamic changes, nausea, vomiting or any drug induced adverse effects or complications. **Results:** The Mean age of subjects in the study was 34.96 ± 9.43 years and in-group B it was 36.23 ± 12.66 years. The proportion of males and females was 56.6% and 43.3% respectively. Mean body weight of subjects in group A was 64.3 ± 11.8 kgs and in group B it was 65.2 ± 9.7 kgs. Regarding ASA grading, 83.3% and 16.4% of patients belonged to ASA grade I and grade II respectively. [Table 1] Though the mean heart rates of group B appeared to be lower than that of group A at various intervals, there was no statistical significant difference in means between the two groups. [Table 2] Similarly, the mean systolic blood pressures recorded at regular interval of time were found to be lesser in group B when compared with group A but there was no statistical significance. [Table 3] Whereas the mean diastolic blood pressures was found to be higher in group B when compared with group A, but there was no statistical significant difference in mean DBP between the two groups.

INTRODUCTION

A bleeding-free surgical field is crucial for middle ear surgery. Impairment of intraoperative visibility due to bleeding is a problem in ear procedures.^[1] As a result, controlled hypotension helped to reduce intraoperative bleeding. Controlled hypotension is stated as “reduction in systolic blood pressure to 80 - 90 mmHg, a reduction of mean arterial pressure to 50 - 65 mmHg or a reduction of 30% of baseline mean arterial pressure”.^[2]

In middle ear procedures the main techniques to reduce blood loss were mild head end elevation of 15°, and topical application or infiltration of adrenaline (1: 50,000 and 1: 200,000). A mild head end elevation acts by reducing the venous and arterial pressures in head and neck but in turn increases the chance of air embolism. In case of such hypotension, head end elevation would furthermore compromise vascular supply to head and neck.^[1,3,4] Out of the several drugs, dexmedetomidine has emerged as one among the most commonly used drugs in anesthetic field, along with routinely used anesthetic drugs.^[5]

Dexmedetomidine, a highly selective α_2 adreno-receptor agonist mediating analgesia and sedation.^[6] Dexmedetomidine is utilised as an adjunct to general anaesthesia in the preoperative (sedation), intraoperative (analgesia and hemodynamic stability), and postoperative (recovery) phases (no respiratory depression).^[7,8] Major side effects noted following the infusion of dexmedetomidine are hypotension and bradycardia.^[9]

The elimination half-life of dexmedetomidine is 2 hours and its redistribution half-life is 6 mins, and this short life makes it a ideal drug for intravenous infusions. Hence a study was conducted to assess the effects of dexmedetomidine in lower doses on, hemodynamic parameters like heart rate and blood pressure, bleeding in surgical field.

MATERIALS AND METHODS

A randomized prospective study was conducted after the prior approval by the institutional ethical committee at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh during the period of November 2019 to October 2021. The sample size at 95% confidence interval with standard deviation of heart rate with conventional procedure at 12.8 beats per minute.10 and expected difference of heart rate of 10 beats per minute was estimated to be 30 per each group. Subjects belonging to American Society of Anaesthesiologists (ASA) physical status I and II of both genders, aged 18-60 years, weighing more than 45 kgs, posted for elective middle ear surgery were enrolled for the study. Patients suffering from cardiovascular diseases, hypovolemia, bradycardia, hepatic impairment, diabetes mellitus, mothers who are pregnant and lactating, patients who are on sedatives and hypnotics and patients with dexmedetomidine allergy were excluded. All patients were evaluated one day prior to surgery, during pre-operative evaluation and informed consent was taken.

Computer generated random table number randomly divided patients into two groups of 30 patients each. Group A received dexmedetomidine 0.25mcg/kg/hr iv infusion continuously at rate of 0.05ml/kg/hr from a prepared dexmedetomidine diluted in saline to a concentration of 5mcg/ml. Group B received dexmedetomidine 0.5mcg/kg/hr iv infusion continuously at rate of 0.05ml/kg/hr from a prepared dexmedetomidine diluted in saline to a concentration of 10mcg/ml. After securing a venous access using a 18G cannula, patient was preloaded with Ringer’s Lactate infusion at rate of 5ml/kg/hr. On arrival to operation room, baseline HR, NIBP, ECG, SPO2 was recorded and monitoring was started. Patients were given premedication with Inj. Glycopyrrolate 0.005mg/kg, Inj. Fentanyl citrate 2 mcg/kg and Inj. ondansetron 4 mg, 10 minutes prior to anaesthetic induction. After preoxygenation for 3 minutes, patient was induced with Inj. Propofol 2 mg/kg till

verbal command is lost and tracheal intubation with appropriate size oral endo tracheal tube was advanced with Inj. Succinyl choline 2 mg/kg. Dexmedetomidine infusion was started after induction of anesthesia up to 20mins prior to completion of the surgery. Anaesthesia was maintained using 60 percent nitrous oxide in oxygen, isoflurane as an inhalational anaesthetic, and Inj. vecuronium as a muscle relaxant at a loading dose of 0.1 mg/kg. Isoflurane concentration was gradually titrated to achieve SBP of 30% below the preoperative values. The patient was ventilated mechanically to maintain ETCO₂ between 30 – 35 mmHg. Intra operatively, HR, NIBP, ECG, ETCO₂ and SPO₂ were monitored continuously and recorded at a interval of every 5 minutes, until end of surgery. Isoflurane concentrations were recorded in percentages every 5 minutes until end of surgery. By reducing dial concentration of isoflurane hypotension was managed or iv fluids infusions and iv atropine was used to treat bradycardia.

The quality of hypotensive anaesthesia was determined by the operating surgeon based on the blood loss at surgical site. Grade 0 is no bleed, excellent surgical condition, no suction needed. Grade 1 is minimal bleed, sporadic suction needed. Grade 2 is diffuse bleed, needed repeated suction. Grade 3 is bleed is troublesome, needed continuous suction. The neuromuscular blockade was reversed with injections of 0.05 mg/kg neostigmine and 0.008 mg/kg glycopyrrolate at end of surgery. After adequate spontaneous breathing efforts and motor recovery, the patient was extubated. Patient later transferred to PACU to be observed for respiratory

depression, sedation score, haemodynamic changes, nausea, vomiting or any drug induced adverse effects or complications.

RESULTS

The Mean age of subjects in the study was 34.96 ± 9.43 years and in-group B it was 36.23± 12.66 years. The proportion of males and females was 56.6% and 43.3% respectively. Mean body weight of subjects in group A was 64.3 ± 11.8 kgs and in group B it was 65.2 ± 9.7 kgs. Regarding ASA grading, 83.3% and 16.4% of patients belonged to ASA grade I and grade II respectively.[Table 1]

Though the mean heart rates of group B appeared to be lower than that of group A at various intervals, there was no statistical significant difference in means between the two groups. [Table 2] Similarly, the mean systolic blood pressures recorded at regular interval of time were found to be lesser in group B when compared with group A but there was no statistical significance. [Table 3] Whereas the mean diastolic blood pressures was found to be higher in group B when compared with group A, but there was no statistical significant difference in mean DBP between the two groups. [Table 4]

Regarding bleeding at surgical field, 80% surgeons reported grade 1 surgical field bleed and 20% had reported grade 0. None of the groups had grade 2 or 3 suggestive of major bleed. Thus, suggesting that both groups had an excellent surgical field that was favourable to surgeons.[Figure 1]

Table 1: Demographic particulars of subjects

Parameter	Group A (N=30)	Group B (N=30)
Age in years(mean±SD)	34.96±9.43	36.23±12.66
Body weight in Kg (mean± SD)	64.3±11.8	65.2±9.7
Gender (Male/Female)	17/13	16/14
ASA grading (I/II)	26/4	24/6

Table 2: Heart rate comparison between two groups

Heart rate (beats/minute)	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	90.1	16.7	88.8	15.4	0.36
After induction	83.1	14.4	84.7	14.5	0.32
After intubation	80.4	11.7	76.4	11.5	0.07
5 Min	77.1	11.9	68.6	11.5	0.06
30 Min	71.7	10.8	67.2	11.8	0.23
60 Min	68.9	9.9	66.6	11.2	0.09
90 Min	68.8	8.4	66.7	10.4	0.13
120 Min	68.8	8.4	65.2	10.5	0.18
After extubation	68.6	8.1	65.9	9.2	0.11

Table 3: Systolic blood pressure comparison in two groups at various intervals

Systolic blood pressure (in mm of hg)	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	110.5	23.1	99.8	4.7	0.07
After induction	103.2	10.7	96.8	4.7	0.09
After intubation	98.4	7.6	94.8	4.7	0.06
5 Min	99.1	6.8	91.9	4.8	0.08
30 Min	97.1	6.9	91.4	3.5	0.18
60 Min	96.4	10.1	91.3	3.7	0.24
90 Min	96.6	8.3	91.7	4.7	0.15
120 Min	94.5	7.8	91.8	4.8	0.21

After Extubation	96.3	9.8	93.0	5.8	0.17
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Table 4: Diastolic blood pressure comparison in two groups at various intervals

Diastolic blood pressure (in mm of hg)	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	76.4	13.1	79.8	5.9	0.10
After induction	71.6	9.4	76.6	6.2	0.21
After intubation	80.9	21.3	77.1	7.5	0.13
5 Min	66.1	9.8	71.4	7.3	0.11
30 Min	65.7	9.9	67.7	6.6	0.21
60 Min	63.8	7.6	66.9	6.5	0.19
90 Min	62.7	7.6	65.2	6.2	0.23
120 Min	63.1	6.9	64.1	5.7	0.16
After extubation	64.2	8.7	63.1	5.8	0.13

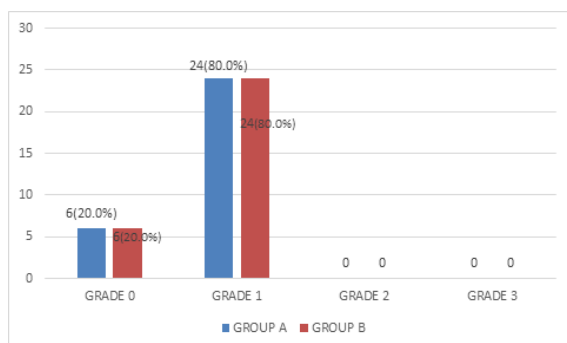


Figure 1: Surgical field bleed grading

DISCUSSION

There are number of techniques/agents have been advocated to achieve hypotension during surgeries of middle ear. Dexmedetomidine is the most commonly used pharmacological medication for providing hypotensive anaesthesia for middle ear surgeries.^[7,11] Dexmedetomidine is an alpha2 adrenoceptor agonist with a high selectivity for alpha-2a receptors, which causes sedation and analgesia. Course of its action is predictable and has dose dependent haemodynamic effects. Dexmedetomidine is helpful in attenuating haemodynamic response during peri-operative period because of its central sympatholytic effect. It has been used with success intravenously with doses ranging from 0.25mcg/kg/hr to 1 mcg/kg in inhibiting intubation response. Major side effects noted following dexmedetomidine infusion are hypotension and bradycardia.

Several methods are used to produce oligemic field during surgery like reverse Trendelenburg position, use of vasoconstrictor drugs with local anesthetic, and Pharmacological agents to reduce blood pressure. Reduced blood extravasation provides surgeons with better visibility and ease of operation, resulting in a shorter operating time. In a study by Guler et al, raise in blood pressure and heart rate during extubation is decreased. No drug related complications or side effects was seen in any patients during both intra operative period and post operative period.^[12]

In current study dexmedetomidine infusion of 0.25mcg/kg/hr and 0.5mcg/hg/hr was used both provided effective hypotensive anaesthesia. but 0.5mcg/hr produced bradycardia in two patients for which atropine was given. Thus 0.25mcg/kg/hr is

sufficient to produce hypotensive anaesthesia without any hemodynamic changes. but 0.5mcg/hr produced bradycardia in two patients for which atropine was given. Similar observation was reported in another study which was attributed to deep sedation.^[13]

In the current study there was no significant difference in mean arterial pressure, SPO2 levels among the two groups. Isoflurane requirement to reduce SBP to 30% of the baseline values was significantly less, but much lesser in group B than in group A. surgeons graded bleeding in the surgical field as grade 1 and 0 in 80% and 20% among both groups. Similar findings were observed in study where dexmedetomidine infusion was proved to be safe in providing an oligaeic operative field for better visibility under the operating microscope surgeries of middle ear while keeping haemodynamic changes within physiological range. It also decreased the need for isoflurane, and anaesthetic recovery was complete and pleasant.10 Sedation score of patients were acceptable in both groups in the post operative period.

CONCLUSION

It can be concluded from the current study that dexmedetomidine at lower dosages, i.e. 0.25mcg/kg/hr, can be utilised safely to provide a bloodless surgical field in middle ear procedures by allowing hemodynamic changes within the physiological limit.

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