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RESEARCH ARTICLE

DEXMEDETOMIDINE FOR MAINTAINING HYPOTENSIVE ANAESTHESIA IN MIDDLE EAR SURGERIES

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ABSTRACT

Middle ear surgeries require hypotensive anaesthesia which is a technique to decrease intraoperative bleeding and improve the quality of the surgical field for better visualization. Dexmedetomidine is a new generation highly selective α-2 adrenoreceptor agonist. It decreases heart rate and arterial blood pressure by reducing norepinephrine and epinephrine plasma levels. The primary objective of our study was to evaluate the effect of loading dose on prevention of stress response during laryngoscopy followed by infusion of dexmedetomidine on haemodynamic parameters, quality of surgical field and post operative sedation. Patients received 1µg/kg body weight of Dexmedetomidine infusion intravenously over 10 min before induction, followed by 0.4 µg/kg/hour infusion during surgery in group D comparing to normal saline in group N. From study we have observed that intravenous infusion of 1µg/kg loading dose followed by continuous infusion 0.4µg/kg/min dexmedetomidine resulted in reduction in isoflurane requirement as compared to saline group. There was statistically significant reduction in pulse rate and blood pressure from base line values after loading dose infusion over 10 min. Dexmedetomidine infusion maintaince a stable haemodynamics including superior quality of surgical field throughout intraoperative period and decreases sympathetic response to intubation. Dexmedetomidine infusion resulted in some degree of sedation postoperatively but there is no statistically significant difference in sedation in comparison to saline group.

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INTRODUCTION

Middle ear surgeries require hypotensive anaesthesia which is a technique to decrease intraoperative bleeding and improve the quality of the surgical field for better visualization. Small bleeds make surgery technically difficult, prolonged surgery time and even compromising the end result. Therefore, anesthetic techniques of induced or controlled or deliberate hypotension, have been widely employed in order to slow the bleeding, providing better surgical field. Several techniques have been used to achieve hypotension during anaesthesia. Direct vasodilators as nitroprusside and nitroglycerine, beta adrenergic antagonists as propranolol and esmolol, alpha and beta adrenergic antagonists as labetalol, inhalational anaesthetics as isoflurane and sevoflurane, opioids like remifentanil, *N*-methyl D-aspartate antagonist as magnesium and alpha-2 adrenergic agonists as clonidine and dexmedetomidine were all used to induce hypotension during middle ear surgery. Dexmedetomidine is a new generation highly selective α-2 adrenoreceptor agonist. It decreases heart rate and arterial blood pressure by reducing norepinephrine and epinephrine plasma levels. Activation of postsynaptic receptors in the central nervous system by α2-agonists inhibits the sympathetic activity and decreases heart rate and blood pressure and causes sedation. It also improves hemodynamic stability during endotracheal intubation and surgical stress by its central sympatholytic action, and thus reduce anaesthetic and opioids requirements. Dexmedetomidine compared to Clonidine is a much more selective alpha2-adrenoceptor agonist, which mightpermit its application in relatively high doses for sedation and analgesia without the unwanted vascular effects from activation of alpha1-receptors. In addition, Dexmedetomidine is shorter-acting drug than clonidine and has a reversal drug for its sedative effect, Atipamezole. These properties render Dexmedetomidine suitable for sedation and analgesia during the whole perioperative period. The primary objective of our study was to evaluate the effect of loading dose on prevention of stress response during laryngoscopy followed by infusion of dexmedetomidine on haemodynamic parameters, quality of surgical field and post operative sedation.

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Aims and objectives

The purpose of this study was to evaluate the use of intravenous dexmedetomidine as an anaesthetic adjuvant in the intraoperative period at a loading dose of 1 µg/kg for 10 minutes, followed by a continuous infusion of 0.4µg/kg/hour, throughout intraoperative period with the following aims and objectives-

a) To study the effect of dexmedetomidine on cardiovascular response to intubation.
b) To study the intraoperative haemodynamic parameters in terms of induced hypotension with the use of intravenous dexmedetomidine infusion.
c) To observe the requirements of inhalational agents.
d) To study the postoperative recovery and sedation.
e) To observe any adverse effects associated with the intra-venous administration of Dexmedetomidine.

MATERIALS AND METHODS

Fifty patients aged between 18 years and 50 years, of either sex belonging to ASA class I and class II posted for middle ear surgeries at our institute were randomly selected for the study.
Group D: (n=25) Patients received 1µg/kg body weight of Dexmedetomidine infusion intravenously over 10 min before induction, followed by 0.4 µg/kg/hour infusion during surgery.

Group S: (n=25) Patients received normal saline intravenously at the same rate.

Inclusion Criteria:

- Age of patients: 18-50 years
- Either gender
- ASA(American Society of Anaesthesiologist) grade I and II
- Undergoing middle ear surgery under general anaesthesia.

Exclusion Criteria

- Patient refusal
- Allergy to drug
- Patients with hypertension, cardiac, renal, hepatic & cerebral diseases.
- Patients with difficult airway and obese patients.

The study drug was prepared in paediatric infusion set dosifix and Dexmedetomidine 100µg (1ml) was added to 0.9% normal saline (99ml) to make a total volume of 100ml (resulting concentration 1µg/ml). After 5 min of monitoring period patient's baseline parameters like pulse, blood pressure, respiratory rate, SpO_2 were recorded. Loading dose of study drug Dexmedetomidine 1µg /kg dose is given over 10 min intravenously, before induction.

Pulse and blood pressure were recorded at the end of 10 min infusion. It is followed by continuous infusion of 0.4µg/kg/min during surgery. In control group patients, saline infusion is given in similar manner.

- All patients were preoxygenated with 100% oxygen for 3 min using Bain's circuit and received.
- Premedication: Inj. Ondansetron 0.15 m Inj. Glycopyrrolate 0.004 mg/kg Inj. Fentanyl 1 µg/kg

Induction and intubation

All patients were induced 10 minutes after starting the infusion of the study drug. Patients were induced using Inj. Thiopental 5mg/kg. Endotracheal intubation was facilitated using Inj. Succinylcholine 2 mg/kg and intubation done using an appropriate cuff endotracheal tube. Positive pressure ventilation was started. $Etco_2$ monitoring was started.

Maintenance

Anaesthesia was maintained using oxygen (50%) nitrous oxide (50%) inhalational agent Isoflurane and intermittent doses of Inj.vecuronium.Anaesthesia was maintained with isoflurane using the lowest possible concentration necessary to keep blood pressure and heart rate within 30% limits of the patient's pre- operative baseline value. Dexmedetomidine infusion was switched off immediately after graft insertion.

Monitoring

Parameters to be observed:

- NIBP(SBP, DBP, MBP)
- HR
- SpO_2
- $EtCO_2$
- Isoflurane concentrations
- Quality of surgical bleeding
- Post operative sedation score

Hemodynamic variables will be recorded before laryngoscopy and post-intubation at 2min, 5 min & 10 min and then every five minutes for the first 30 minutes. Thereafter they will be recorded every 15 min till surgery lasts. Monitoring of end tidal concentration of isoflureane and $EtCo_2$ started after intubation. End tidal isoflureane concentration noted after every 15 min and also whenever concentration was changed to maintain the haemodynamic parameters within 30% of baseline value. Bradycardia will be treated with Inj Atropine 0.6 mg i.v. The surgeon will be asked to assess the quality of the surgical field according to the quality scale proposed by Fromme and colleagues.

0 = no bleeding.
1 = slight bleeding – blood evacuation not necessary.
2 = slight bleeding – sometimes blood has to be evacuated.
3 = low bleeding – blood has to be often evacuated. Operative field is visible for some seconds after evacuation.
4 = average bleeding – blood has to be often evacuated.
5 = high bleeding – constant blood evacuation is needed. Sometimes bleeding exceeds evacuation. Surgery is hardly possible.

Reversal and Extubation

All patients were reversed using Inj. Glycopyrrolate 0.008 mg/kg and Inj. Neostigmine 0.05 mg/kg. After thorough oral and endotracheal suction patients were extubated after they satisfied the criteria for extubation. All patients were then shifted to the post-operative room and apart from NIBP, HR and other variables post operative sedation induced by dexmedetomidine will also be observed by Ramsay Sedation Scale every 30 min for next 2 hours. Any post-operative complications were noted and treated accordingly.

Sedation Scoring

Post-operative sedation was assessed at regular intervals postoperatively using Ramsay Sedation Scale.

1. Patient is anxious and agitated or restless or both.
2. Patient is co-operative, oriented and tranquil.
3. Patient responds to commands only.
4. Patient exhibits brisk response to light glabellar tap or loud auditory stimulus.
5. Patient exhibits sluggish response to light glabellar tap or loud auditory stimulus.
6. Patient exhibits no response.

Statistical Analysis

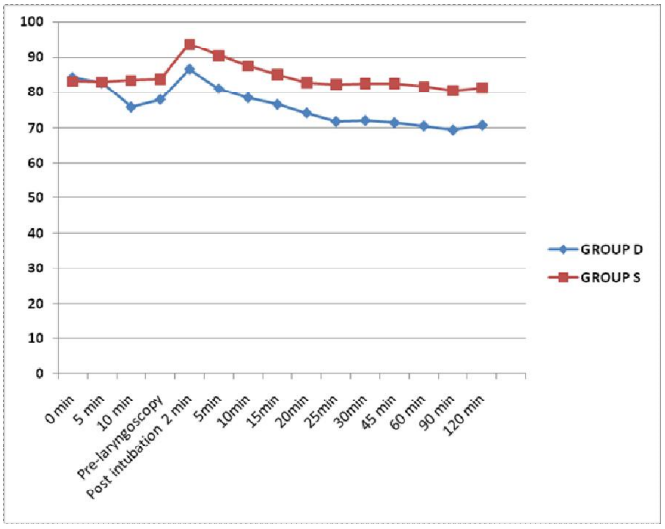
All the observations were recorded and all the results were analysed. Statistically data were presented as mean ± S.D. The results of the intended study between two groups were compared statistically using 'p' value obtained from Student 't'test. A value of P<0.05 was considered as statistically significant difference.

OBSERVATIONS & RESULTS

After studying 50 cases, the observations and results were summarized in tabulated form. The patients were divided intotwo groups with 25 patients in each group (n=25). In Group D patients received 1µg/kg of dexmedetomidine infusion over 10 min followed by 0.4µg/kg/hours infusion while in Group S patients received normal saline at the same rate.

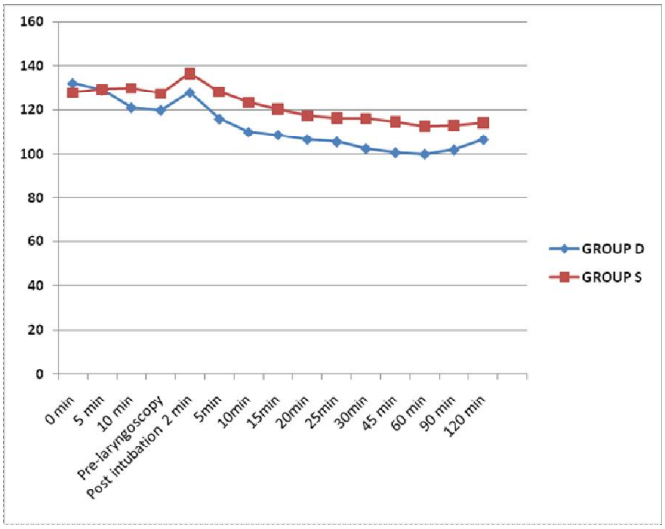
- Distribution of patients according age, weight and sex incidence in both groups had no significant difference
- There was a significant reduction in HR of 9.53% from base line following the loading dose of dexmedetomidine. (Group D base line at 0 min 84.2±8.03, 10 min 75.8±8.54) (P value <0.05)
- Pulse rate is significantly lower in dexmedetomidine group throughout the intraoperative period in comparison to saline group. (P value <0.05)
- Maximum reduction in heart rate in dexmedetomidine group occurs around 60-90 min post intubation (post intubation 60min 70.56±5.91, 75 min 69.44±5.24).

Systolic blood pressure-Pre-induction systolic blood pressure values were comparable between the two groups. After loading infusion of drug there is statistically significant fall in systolic blood pressure of 6.32% from baseline in Group D but no such reduction in systolic blood pressure seen in Group S. (P value<0.05) (Group D–BASELINE 0 min132.1±10.64, 10 min 120.84±9.65). Throughout intra-operative period dexmedetomidine receiving patients have lower blood pressure in comparison to saline group.



Diastolic blood pressure

- Baseline diastolic blood pressure was similar in both the groups without any statically significant difference.
- There was significant reduction of 7.48% in diastolic blood pressure in Group D patients after infusion of dexmedetomedine. (Group D -BASE LINE 0 min 80.72±7.16, 10min 75.08±7.49) (P value<0.05)
- Throughout intraoperative period dexmedetomidine receiving patients have less blood pressure in comparison to saline group.

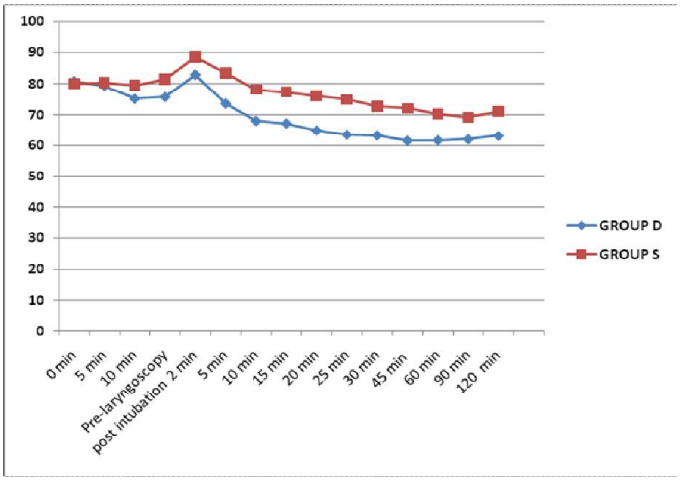


Mean arterial blood pressure

- Baseline values were similar in both the groups.
- After administration of loading dose of dexmedetomidine there is fall in mean arterial blood pressure of 9.02% from baseline value (BASELINE- 0

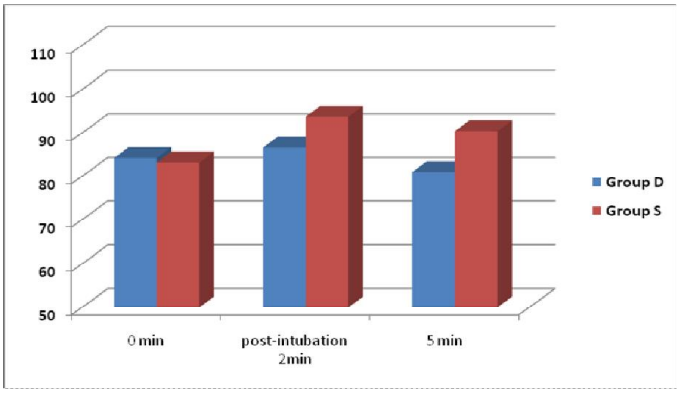
min 97.76±8.43, 10 min-89.92±7.85) and no such decrease in arterial blood pressure seen saline group. (P value<0.05)

- Throughout intraoperative period mean arterial blood pressure was significantly lower in Group D as compared to Group S.



Effect of dexmedetomidine on pulse rate during laryngoscopy and intubation

From above observation it can be seen that after intubation and laryngoscopy there was increase in pulse rate and blood pressure in both the group from baseline values. Maximum increase in pulse rate and blood pressure occur at 2 min of intubation in both the groups. Dexmedetomidine receiving patients increase in heart rate and blood pressure values were significantly lower as compared to saline group.

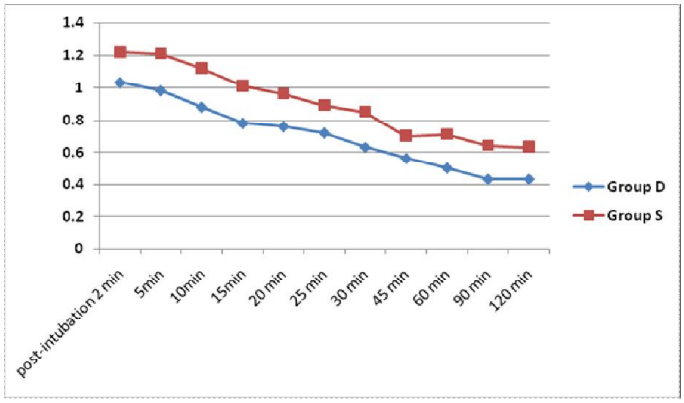


End tidal isoflurane concentration

Mean isoflurane concentration over intraoperative period is significantly less in Group D as compared to Group S. It can be seen that requirement in Group D is less in comparison to Group S.

Quality of bleeding

	GRADE OF BLEEDING	
	GROUP D	GROUP S
MEAN	1.72	3
SD	0.61	0.64



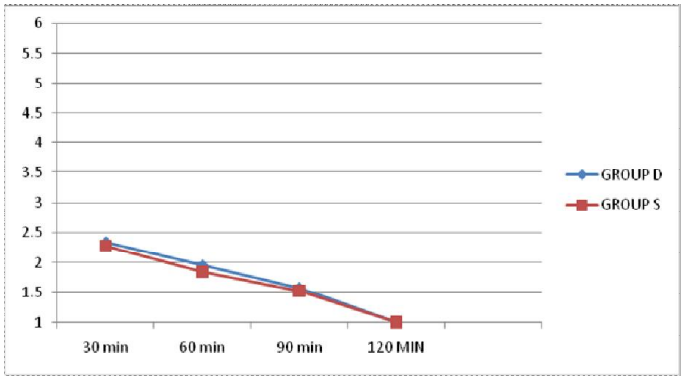
Quality of bleeding

	GRADE OF BLEEDING	
	GROUP D	GROUP S
MEAN	1.72	3
SD	0.61	0.64

The surgeon who was not aware of the selected hypotensive agent was asked to assess the quality of the surgical field according to the quality scale proposed by Fromme and colleagues.

Sedation score

During postoperative period Ramsay sedation score is more in Group D Patients in comparison to Saline group, but this difference is not statically significant. Two patients developed bradycardia and Three Patients have hypotension in group D during the procedure. But these complications were managed with atropine and fluid administration respectively.



DISCUSSION

This study was conducted on 50 patients of 18 to 50 years of age, of either gender, of ASA physical status I or II, posted formiddle ear surgeries. They were randomly divided into two groups of 25 patients each. Group D: (n=25) Patients received 1µg/kg body weight of Dexmedetomidine infusion intravenously over 10 min before induction, followed by 0.4 µg/kg/hour infusion during surgery. Group S: (n=25) normal saline intravenously at the same rate. All patients were started with the drug or saline infusion 10 minutes before induction of general anaesthesia given1µg/kg body weight of Dexmedetomidine infusion intravenously over 10 min before

induction, followed by 0.4 µg/kg/hour infusion during surgery. Anaesthesia was maintained with isoflurane using the lowest possible concentration necessary to keep blood pressure and heart rate within 20% limits of the patient's pre- operative baseline value. Dexmedetomidine infusion wasswitched off when graft is inserted and isoflurane administration and nitrous oxide were also discontinued after skin closure. Pulse rate, blood pressure, oxygen saturationvalues were noted throughout the surgery. Monitoring of end tidal concentration of isoflureane and $EtCo_2$ started after intubation. Post-operative sedation scoring was done as per Ramsay sedation scale. From study we have observed that intravenous infusion of 1µg/kg loading dose followed by continuous infusion 0.4µg/kg/min dexmedetomidine resulted in reduction in isoflurane requirement as compared to saline group. There was statistically significant reduction in pulse rate and blood pressure from base line values after loading dose infusion over 10 min. Dexmedetomidine infusion maintaince a stable haemodynamics including superior quality of surgical field throughoutintraoperative period and decreases sympathetic response to intubation. Dexmedetomidine infusion resulted in some degree of sedation postoperatively but there is no statistically significant difference in sedation in comparison to saline group.

From these observations, the following conclusions were made:

Perioperative Dexmedetomidine infusion

1. Attenuates the sympathetic hemodynamic response to both laryngoscopy and intubation.
2. Reduces the intraoperative requirement of isoflurane.
3. Maintains stable haemodynamics during intraoperative period.
4. Produces good surgical field and post-operative sedation is not significant enough.
5. There were no notable post-operative complications either due to the drug or due to the procedure in our study.

To conclude, Dexmedetomidine, a newer highly selective α_2 agonist, when given as an infusion at a dose of 1µg/kg over 10 min followed by 0.4µg/kg/min maintains hemodynamic stability during middle ear surgery, produces hypotension, good surgical field and reduces requirements of isoflurane without causing significant sedation.

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