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Dexmedetomidine infusion during middle ear surgery using operating microscope under general anaesthesia to provide oligaemic surgical field: An observational study

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Abstract
Background: Dexmedetomidine is a highly selective α2 adrenergic agonist and used as adjuvant in anaesthesia to reduce the intra-operative anaesthetic and analgesic requirement. It regulates the autonomic and cardiovascular systems by acting on blood vessels and inhibiting norepinephrine release at sympathetic terminals, thereby attenuating the heart rate and blood pressure responses to intra-operative stressful events of anaesthesia. It effectively minimises the surgical blood loss and improves the surgical field visibility. Its haemodynamic effects are predictable and dose-dependent.
Objectives: To observe any inadvertent adverse effects associated with the intravenous administration of dexmedetomidine as an anaesthetic adjuvant.
Methods: Sixty adult patients in two groups aged 18-58 years, weighing 45-80 kg, of either sex belonging to ASA classification 1 and 2 posted for middle ear surgeries at our institute. Results: Majority of our patients in Group A i.e. 11 (33.3%) and Group B i.e. 9 (33.3%) were 50-59 years of age. The mean age in Group A patients was 40.7±11.84 years and in Group B it was 42.7±10.33 years. Mean heart rate in Group A was 89.30 and in Group B it was 88.19. Mean SBP was 130.45 and 129.19 in Group A and Group B. Mean DBP was 85.61 in Group A and 84.22 in Group B. Mean MAP was 100.56 and 99.21 in Group A and Group B. Mean SpO_2 was 97.61 and 97.48 in Group A and Group B. Mean duration of surgery was 131.5 minutes and 129.8 minutes in Group A and Group B. When heart rate was compared at different time intervals, the overall time interval was 71.14 in Group A and 83.07 in Group B. When systolic blood pressure (SBP) was compared at different time intervals, the overall time interval was 100.49 in Group A and 119.27 in Group B. When diastolic blood pressure (DBP) was compared at different time intervals, the overall time interval was 65.74 in Group A and 77.06 in Group B. When mean arterial pressure (MAP) was compared at different time intervals, the overall time interval was 77.32 in Group A and 91.06 in Group B.
Conclusion: They concluded that dexmedetomidine infusion can be safely used to decrease intra-op bleeding for better visualization during middle ear microsurgery.

Keywords: Parental attitude, participation, sports, girls

Introduction
Middle ear surgery under general anaesthesia is revolutionised with the introduction of hypotensive anaesthesia that provides relatively bloodless field for better visualization while using an operating microscope. Small bleeds make surgery technically difficult, prolonged surgery time and even compromising the end result. Several techniques have been used to achieve hypotension during anaesthesia. The primary methods to minimise blood loss during middle ear surgery included mild head elevation of 15 degree, and infiltration or topical application of Epinephrine (1:50,000 or 1:200,000) [1, 2].
Numerous pharmacological agents effectively lower the systemic blood pressure for hypotensive anaesthesia. Direct vasodilator so as Nitropruside and Nitroglycerin, Beta adrenergic antagonist as Propranolol and Esmolol, alpha and beta adrenergic antagonist as Labetalol, inhalational anaesthetics as Isoflurane and Sevoflurane, opioid like Memefentanil, N-methyl D-Aspartate antagonist like magnesium and alpha-2 adrenergic agonist as Clonidine and Dexmedetomidine.
In moderate concentrations, isoflurane lowers blood pressure via a vasodilating effect while preserving cerebral autoregulation. However, at higher concentrations it causes an increase in

intracranial pressure due to increased cerebral blood flow and impairment of cerebral autoregulation [3].

The alpha-2 adrenoceptor agonists, clonidine and dexmedetomidine, have sedative and analgesic properties. They also markedly reduce catecholamine secretion, are anesthetic sparing, and produce moderate bradycardia and hypotension [4, 5, 6].

Dexmedetomidine is a highly selective α2 adrenergic agonist and used as adjuvant in anaesthesia to reduce the intra-operative anaesthetic and analgesic requirement. It regulates the autonomic and cardiovascular systems by acting on blood vessels and inhibiting norepinephrine release at sympathetic terminals, thereby attenuating the heart rate and blood pressure responses to intra-operative stressful events of anaesthesia. It effectively minimises the surgical blood loss and improves the surgical field visibility. Its haemodynamic effects are predictable and dose-dependent [7, 8, 9].

Aims and objectives

The purpose of this study is to evaluate the intravenous use of dexmedetomidine as an anaesthetics adjuvant with following aims and objectives:

1) As hypotensive anaesthesia to provide bloodless field for middle ear surgery using operating microscope.
2) Effects of dexmedetomidine infusion on requirement of isoflurane concentration to lower systolic blood pressure below 30% of baseline values.
3) To study intra -operative haemodynamic parameters in terms of induced hypotension with the use of intra venous dexmedetomidine infusion.
4) To study postoperative analgesia.

Material and methods

The present observational study was conducted in the Postgraduate Department of Anaesthesiology and Critical Care, in collaboration with the Department of ENT, H&NS, Government Medical College, Srinagar. The study was done over a period of two years after obtaining the ethical clearance from the Institutional Ethical Committee. Sixty adult patients were included in the study equally distributed in two groups of 30 patients each. Patients who received dexmedetomidine infusion during middle ear surgery operating under microscope under general anesthesia were observed as group A and those patients undergoing middle ear surgery under operating microscope under general anaesthesia but not received dexmedetomidine infusion were observed as group B.

Inclusion criteria

- Age of patients 18-58 years
- Either gender
- ASA (American Society of Anaesthesiologist) grade 1 and 2nd)
- Undergoing middle ear surgery using operating microscope under general anaesthesia.

Exclusion criteria

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

Hemodynamic variables were recorded before laryngoscopy and post intubation every five minutes till surgery lasts. The surgeon was asked to assess the quality of surgical field ASA:

Grade 0 no bleeding, excellent surgical conditions
Grade 1 minimum bleeding, sporadic suction needed
Grade 2 diffuse bleeding, repeated suction needed
Grade 3 considerable, troublesome bleeding and continuous suction needed.

Results

Majority of our patients in Group A i.e. 11 (33.3%) and Group B i.e. 9 (33.3%) were 50-59 years of age. The mean age in Group A patients was 40.7±11.84 years and in Group B it was 42.7±10.33 years. There were 17 (51.5%) and 15 (55.6%) male patients in Group A and Group B. Female patients constituted 16 (48.5%) and 12 (44.4%) in Group A and Group B. There were 26 (78.8%) and 22 (81.5%) patients in Group A and Group B with ASA status I. In Group A and Group B, there were 7 (21.2%) and 5 (18.5%) with ASA status II.

Mean heart rate in Group A was 89.30 and in Group B it was 88.19. Mean SBP was 130.45 and 129.19 in Group A and Group B. Mean DBP was 85.61 in Group A and 84.22 in Group B. Mean MAP was 100.56 and 99.21 in Group A and Group B. Mean SpO_2 was 97.61 and 97.48 in Group A and Group B. Mean duration of surgery was 131.5 minutes and 129.8 minutes in Group A and Group B. When heart rate was compared at different time intervals, the overall time interval was 71.14 in Group A and 83.07 in Group B. When systolic blood pressure (SBP) was compared at different time intervals, the overall time interval was 100.49 in Group A and 119.27 in Group B. When diastolic blood pressure (DBP) was compared at different time intervals, the overall time interval was 65.74 in Group A and 77.06 in Group B. When mean arterial pressure (MAP) was compared at different time intervals, the overall time interval was 77.32 in Group A and 91.06 in Group B.

When oxygen saturation was compared at different time intervals, the overall time interval was 99.00 in Group A and 98.95 in Group B. Against 33 patients of Group A who needed isoflurane to reduce SBP, and 27 of Group B, mean 0.78 and 1.56 isoflurane concentration was used to reduce SBP. Majority of patients in Group A i.e. 30 (90.9%) had Grade 1 bleeding score while in Group B majority of patients i.e. 16 (59.3%) had Grade 3 bleeding score. Mean time (minutes) request for first analgesia was 117.3 minutes in Group and 40.6 minutes in Group B. Total analgesia consumed (grams) in 33 patients of Group A was 1.24g while as in 27 patients of Group B 2.62g analgesia was consumed.

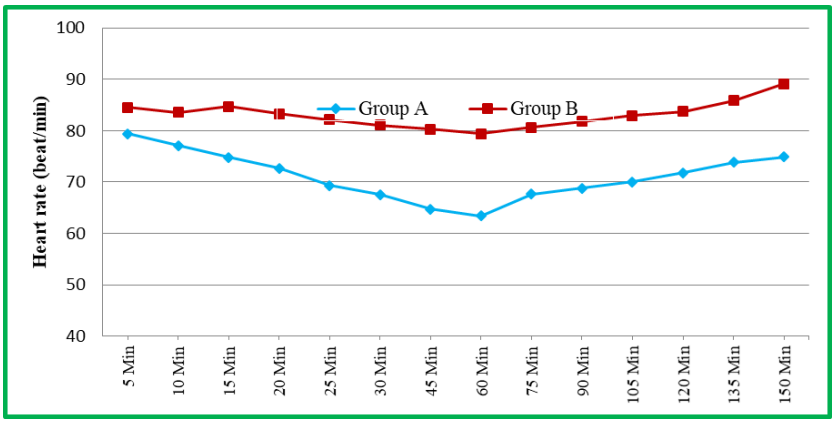

Fig 1: Comparison based on interoperative heart rate (beats/min) in two groups

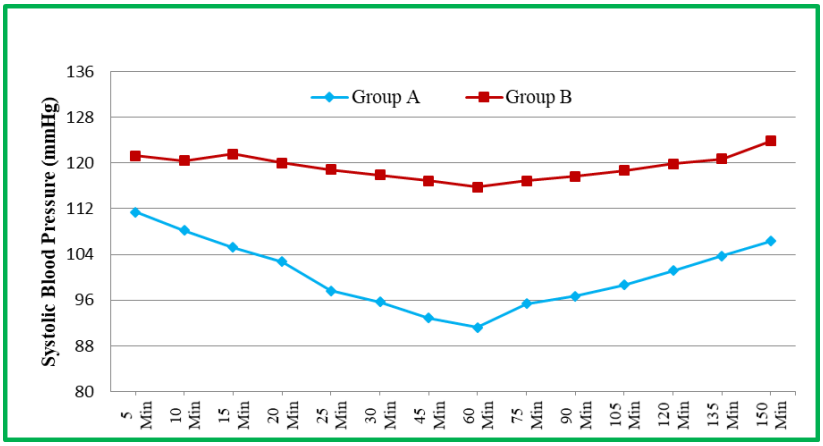

Fig 2: Comparison based on interoperative systolic blood pressure (mmHg) in two groups

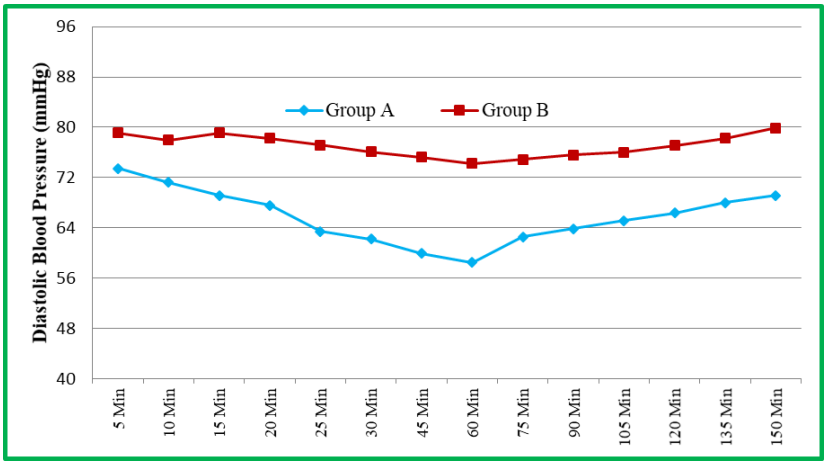

Fig 3: Comparison based on interoperative diastolic blood pressure (mmHg) in two groups

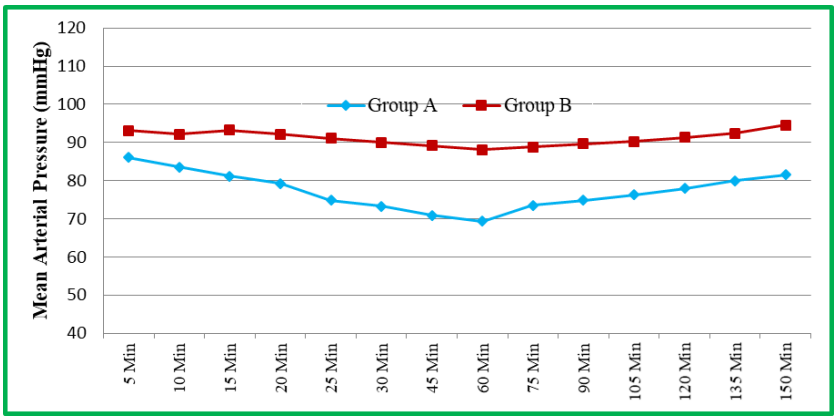

Fig 4: Comparison based on interoperative diastolic blood pressure (mmHg) in two groups

Discussion

Dexmedetomidine has become of the frequently used drugs in anesthetic armamentarium, along with routine anesthetic drugs, due to its haemodynamic, sedative, anxiolytic, analgesic, neuroprotective and anesthetic sparing effects. Other claimed advantages include minimal respiratory depression with cardio protection, neuroprotection and renoprotection, thus making it useful at various situations including offsite procedures [10].

The mean age in Group A patients was 40.7±11.84 years and in Group B it was 42.7±10.33 years. There were 17 (51.5%) and 15 (55.6%) male patients in Group A and Group B. Female patients constituted 16 (48.5%) and 12 (44.4%) in Group A and Group B. There were 26 (78.8%) and 22 (81.5%) patients in Group A and Group B with ASA status I. In Group A and Group B, there were 7 (21.2%) and 5 (18.5%) with ASA status II. Malla SM *et al.,* (2017) [11] conducted a study on forty patients of American Society of Anesthesiologists (ASA) physical status I and II, aged 18-58 years. Patients of Group A received infusion of dexmedetomidine 0.5 µg/kg/h and patients of Group B received placebo infusion of normal saline. Mean age in their study was 31.55±11.56 years in Group A and 30.80±12.37 years in Group B with 15/5 (ASA I) and 17/3 (ASA II) patients. Gupta K *et al.,* (2015) [12] evaluated the clinical effects of dexmedetomidine infusion as anaesthetic adjuvant during middle ear surgery using operating microscope. A total of 60 patients were studied equally distributed in 30 patients each in Dexmedetomidine group and placebo group. Mean age in group A was 29.7±8.3 and mean age in group B was 31.2±6.7. There was male predominance in both the groups with 19 and 17 males compared to 13 and 15 females. Patients with ASA status I were 25 and 23 while as patients with ASA status II were 07 and 09 respectively.

Mean duration of surgery was 131.5 minutes and 129.8 minutes in Group A and Group B. Duration of surgery was 90.45±13.37 minutes in group A and 111.1±19.82 minutes in Group B in another study done by Malla SM *et al.,* (2017) [11]. Mohamed AZ *et al.,* (2015) [13] conducted a study on 60 patients scheduled for middle ear surgery. Patients were randomly divided into two equal groups, the 1st group received dexmedetomidine infusion (D group) while the 2nd received magnesium sulphate infusion (Mg group). Mean surgical time taken in dexmedetomidine group was 160 ± 25 minutes.

When heart rate was compared at different time intervals, the overall time interval was 71.14 in Group A and 83.07 in Group B. When systolic blood pressure (SBP) was compared at different time intervals, the overall time interval was 100.49 in Group A and 119.27 in Group B. When diastolic blood pressure (DBP) was compared at different time intervals, the overall time interval was 65.74 in Group A and 77.06 in Group B. When mean arterial pressure (MAP) was compared at different time intervals, the overall time interval was 77.32 in Group A and 91.06 in Group B. When oxygen saturation was compared at different time intervals, the overall time interval was 99.00 in Group A and 98.95 in Group B.

In a study conducted by Rajani B *et al.,* (2019) [14], there was a statistically significant reduction in HR, SBP, DBP and MAP at various time interval in group D (Dexmedetomidine group) as compared to group C (Control group). Similar results was also found by Turan G *et al.,* (2008) [15] and Durmus M *et al.,* (2007) [16] They found that the heart rate was lower in dexmedetomidine group. Khan ZP *et al.,* (1999) [17], Aaanta R *et al.,* (1997) [18] studies investigated the effects of dexmedetomidine before induction of anesthesia and reported a significant reduction in blood pressure. Gupta K *et al.,* (2015) [12] reported that the baseline mean systolic blood pressure group D 123.4±17.3 mm Hg and group C 127.2±11.5 mm Hg) was comparable81 between the groups. Chiruvella S *et al.,* (2014) [19] in their study, baseline MAP group C was 86.6±12.4mm Hg and in group D 85.8±11.4 mm Hg. MAP dropped significantly ($p<0.01$) Yacout AG *et al.,* (2012) [20] in their study of patients undergoing major surgery with intravenous dexmedetomidine infusion 1 µg/kg bolus dose followed by 0.5 µg/kg/hr intravenous infusion reported that mean arterial pressure was significantly lower along with the significantly less post-operative pain in the dexmedetomidine group. There was no significant change in SpO2 at any time in both the groups ($p>0.05$ in all intervals). Gupta K *et al.,* (2015) [12] reported that peripheral oxygen saturation (SpO2) were comparable in both the study groups with no episode of desaturation at any time.

Conclusion

In conclusion, Dexmedetomidine was effective and safe to provide an oligemic surgical field and hemodyanamic stability during FESS. Dexmedetomidine reduces isoflurane and fentanyl requirements for deliberate hypotension and attenuated cardiovascular responses perioperatively.

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