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DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDEBLOODLESS SURGICAL FIELD

Anaesthesiology

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ABSTRACT

Background : Middle ear is a closed cavity between the tympanic membrane and oval window. Surgeries done here under operating microscope needs bloodless field for better visualization. This bloodless field is achieved through controlled or deliberate hypotension. Non pharmacological methods include arteriotomy, positioning of surgical site higher, and positive pressure ventilation. Pharmacological means can be through intravenous or inhalational agents. Usage of drugs like vasodilators, beta adrenergic antagonists, alpha 2 agonist, calcium channel blockers. Inhalational agents like sevoflurane, isoflurane, desflurane can be used. Dexmedetomidine, a centrally acting alpha 2 agonist is being in used in many countries. The present study was undertaken to compare the effectiveness of dexmedetomidine to provide a bloodless surgical field under general anaesthesia during middle ear surgeries. **AIM OF THE STUDY :** The aim of this study was to study the effect of dexmedetomidine infusion during middle ear surgeries under general anaesthesia to provide bloodless surgical field. **Materials and methods:** This is an observational study, approved by the institutional ethical committee. An informed consent was taken from all patients selected for the study. All patients belonging to ASA grade 1 and 2, between the age group of 18 to 50 years posted for Middle ear surgeries under General anaesthesia. Patients having coagulation disorders, Cardiac diseases, Patients refusal are excluded. This study was conducted on 60 adult patients planned to undergo middle ear surgeries. They were randomly allocated to one of the two study groups. Group I dexmedetomidine group and Group II normal saline group. **Discussion:** Hypotensive anaesthesia during middle ear surgeries are preferred, as bloodless field provides optimal visualization under operating microscope. Relative bloodless field facilitates the placement of graft. Dexmedetomidine, an alpha 2 agonist acts by sympathetic suppression and provides good hemodynamic stability. Present study is based on the effects of dexmedetomidine to provide bloodless field in middle ear surgeries under general anaesthesia. **Conclusion:** Dexmedetomidine infusion at 0.5mcg/kg/hour infusion during general anaesthesia in middle ear surgeries reduces bleeding at surgical site and provides better visibility of the operative field under microscope

KEYWORDS

Middle ear surgeries, General anaesthesia, Hypotension, Dexmeditomidine.

INTRODUCTION

Middle ear is a closed air-filled cavity between the tympanic membrane and oval window. Surgeries done here under operating microscope needs bloodless field for better visualization. This bloodless field is achieved through controlled or deliberate hypotension. Controlled or deliberate hypotensiondefinition can be achieved through multiple modalities. Pharmacological and non pharmacological means can be used to achieve controlled hypotension.

Non pharmacological methods include arteriotomy, positioning of surgical site higher, and positive pressure ventilation. Pharmacological means can be through intravenous or inhalational agents. Usage of drugs like vasodilators, beta adrenergic antagonists, alpha 2 agonist, calcium channel blockers. Inhalational agents like sevoflurane, isoflurane, desflurane can be used.

Dexmedetomidine, a centrally acting alpha 2 agonist is being in used in many countries since many years. In India it was introduced in 2009 Several studies have shown that administration of dexmedetomidine during general anaesthesia reduces the MAC value of sevoflurane.

The present study was undertaken to compare the effectiveness of dexmedetomidine to provide a bloodless surgical field under general anaesthesia during middle ear surgeries.

MATERIALSAND METHOD

This clinical study was conducted in Department of anaesthesiology, Alluri sitaramaraju Academy of medical sciences in association of Department of Oto-rhino-laryngology during the period March 2022 March 2023. Clearance was obtained from hospital ethical committee for the study. This study was conducted on 60 adult patients planned to undergo middle ear surgeries. They were randomly allocated to one of the two study groups. Group I dexmedetomidine group and Group II normal saline group.

PATIENT SELECTION:

INCLUSION CRITERIA:

- ASA I & II
- Age 18 to 45 years
- Scheduled for elective middle ear surgery

EXCLUSION CRITERIA:

- Patient refusal
- Presence of cardiac or respiratory disease
- Hypertension
- Obesity (BMI> 26kg/sq m)
- Hepatic / renal dysfunction
- Bleeding or coagulation disorders
- Anticipated difficult airway
- Patients on sedatives, hypnotics, antihypertensives.

Patients were premedicated with midazolam (2 mg) and fentanyl (2mcg/kg) intravenously 15 minutes before induction of anaesthesia. After preoxygenation with 100% for 3 minutes, induction of anaesthesia with propofol (2 mg/kg) till loss of verbal commands and vecuronium 0.1 mg/kg were used to facilitate tracheal intubation. Group I (DEX) received infusion of dexmedetomidine 0.5 mcg/kg/hour after induction(no bolus?) of anaesthesia till 20 minutes before completion of surgery. 50 mcg of dexmedetomidine was diluted in 100 ml normal saline and infusion rate administered according to body weight of the patient. Group II (NS) received placebo infusion of normal saline 100 ml after induction of anaesthesia till 20 minutes before completion of surgery. Anaesthesia was maintained with sevoflurane was titrated to achieve target BP of either less than 30% of baseline systolic BP or below 30% of baseline MAP whichever is higher.

PROCEDURE

Pre anaesthetic preparation keepingNPO6hours before surgery. Patients were premedicated with ranitidine 0.25mg/kg, ondansetron 4mg and glycopyrrolate 0.04 mg/kg in preoperative room 60 minutes

before surgery. Two separate 18G intravenous lines established. In the operating room On arrival to operation theatre, monitors were attached (heart rate, Spo2, ECG, NIBP) and baseline vital parameters- heart rate, oxygen saturation, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded. Patients were premedicated with midazolam (2 mg) and fentanyl (2mcg/kg) intravenously 15 minutes before induction of anaesthesia. After preoxygenation with 100% for 3 minutes, induction of anaesthesia with propofol (2 mg/kg) till loss of verbal commands and vecuronium 0.1 mg/kg were used to facilitate tracheal intubation. Intraoperative monitoring was done at 10 minutes interval throughout the surgery till the end of the procedure i) Heart rate ii) Systolic blood pressure. iii)Diastolic blood pressure iv) Mean arterial pressure v) Sevoflurane dial concentration. Patients were monitored for any adverse effects like bradycardia and hypotension beyond target blood pressure. Sevoflurane dial concentration was titrated to treat hypotension beyond target blood pressure. At the end of the procedure, surgeon was asked to assess the bleeding at the surgical site. GRADE 0- no bleeding – excellent GRADE 1- minimum bleeding – sporadic suctioning needed GRADE 2- diffuse bleeding – repeated suction needed GRADE 3- considerable troublesome bleeding and continuous suction was needed. Residual neuromuscular blockade after surgery was antagonized with neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg /kg). After adequate motor recovery and spontaneous breathing efforts patients were extubated. Postoperative heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation at the end of 10 minutes after extubation were recorded. Patient was shifted to post op recovery room and monitored for 30 minutes before shifting them to ENT ward.

OBSERVATIONS AND RESULTS:

This is a prospective, randomized, controlled study done in 60 adult ASAI and II patients of either sex aged between 18 – 45 years, posted for elective middle ear surgeries under general anaesthesia. All 60 patients completed the study without any exclusion. Inter group analysis was done and the collected data were analysed using appropriate statistical test.

HAEMODYNAMIC PROFILE:

Table 1: Baseline mean heart rate

S.No	Study group	MEAN±S.D (heart rate / min)	p value	Statistical test
1	GROUP I(DEX)	85.17 ± 1.789	0.521	Un paired 't' test
2	GROUP II(NS)	86.60 ± 1.322		

p value was 0.521, hence baseline hear rate among both groups were statistically insignificant.

Table 2: Intraoperative heart rate

S. No	Heart rate at various time	DEX group (n=30)	Normal Saline Group (n=30)	P value	95 % Confidence interval
1	Pre-operative	85.17 ± 9.7	86.6 ± 7.24	0.521	-5.29 to 8.157
2	At induction (0 mins)	99 ± 12.61	98.2 ± 11.61	0.966	-7.523 to 5.923
After induction:					
3	10 mins	73.8 ± 6.38	90.03 ± 10.1	<0.0001	9.51 to 22.96
4	20 mins	68.8 ± 5.64	86.07 ± 9.27	<0.0001	10.54 to 23.99
5	30 mins	65.7 ± 6.43	82.2 ± 7.4	<0.0001	9.77 to 23.22
6	40 mins	62.77 ± 3.7	79.5 ± 6.42	<0.0001	10.01 to 23.46
7	50 mins	62 ± 3.76	77.37 ± 6.4	<0.0001	8.64 to 22.09
8	60 mins	61.48 ± 3.69	76.33 ± 6.56	<0.0001	8.06 to 21.63
9	70 mins	61.42 ± 2.56	74.67 ± 2.56	<0.0001	6.26 to 20.22
10	80 mins	62 ± 2.44	73.8 ± 6.08	<0.0001	4.58 to 19.02
11	90 mins	62 ± 1.41	73.69 ± 6.06	<0.05	0.72 to 22.66
12	Post extubation 10 mins	68.77 ± 4.54	91.6 ± 6.24	<0.0001	16.11 to 29.56

Dexmedetomidine group showed significantly lower heart rate ranging from 60 to 90 beats per minute, while normal saline group showed heart rate ranging from 70 to 100 beats per minute. Two-way ANOVA with bonferroni post hoc test was performed to test the statistical significance. p value was < 0.0001, hence statistically significant.

Table 3: Sevoflurane requirement to reach target blood pressure.

S. No	Group name (n=30/group)	Percentage of sevoflurane (MEAN±SD)	p value
1	GROUP I(DEX)	0.72±0.13	<0.0001
2	GROUP II(NS)	1.43±0.32	

Mann- Whitney U test was used to test the level of significance with p value<0.0001, hence statistically significant. Thus dexmedetomidine group had a significantly lesser requirement of sevoflurane dial concentration to achieve and maintain target blood pressure than normal saline group.

Table 4: Grade of bleeding

S.No	Group name	Grade of bleeding (n=30)		P value	Statistical test
		Grade 1	Grade 2		
1	GROUP I(DEX)	27 (90%)	3 (10%)	<0.0001	Chi square test for proportions
2	GROUP II(NS)	7 (23.3%)	23 (76.7%)		

p value <0.0001, hence significant. Thus patients of dexmedetomidine group had statistically significant lower grade of bleeding than normal saline group.

Table 5 : Time to attain target blood pressure

S.No	Group name n=30/group	Time to achieve target BP (mean ± SD) minutes	p value	Statistical test
1	GROUP I(DEX)	24±7.24	<0.0001	Mann Whitney U test
2	GROUP II(NS)	48.67±8.60		

p value was <0.0001, hence statistically significant. Thus it is inferred that dexmedetomidine group required lesser time to attain target blood pressure than normal saline group.

Table 6: Duration of surgery

S.No	Group	MEAN± S.D (minutes)	p value	Statistical Test
1	GROUP I(DEX)	99.01 ± 2.05	<0.0001	Student 't'test
2	GROUP II(NS)	131.7 ± 2.99		

p value was <0.0001, hence statistically significant. The duration of surgery was significantly lower in dexmedetomidine group than normal saline group.

DISCUSSION:

Hypotensive anaesthesia during middle ear surgeries are preferred, as bloodless field provides optimal visualization under operating microscope. Relative bloodless field facilitates the placement of graft. Under operating microscope even a minimal bleed is visualised as major one hence it's a challenge to anaesthesiologist to provide bloodless field.

Various pharmacological means can be used to provide hypotensive anaesthesia, like directly acting vasodilators, beta blockers, calcium channel blockers, inhalational agents. Dexmedetomidine, an alpha 2 agonist acts by sympathetic suppression and provides good hemodynamic stability.

Not many studies have been conducted to study the effect of dexmedetomidine to provide controlled hypotension in middle ear surgeries. So we planned for a prospective, randomized study in of dexmedetomidine to provide bloodless field in middle ear surgeries under general anaesthesia. 60 ASA physical status I and II patients, aged between 18 -45 years planned for elective middle ear surgeries were enrolled in this study after obtaining consent. They were randomly allocated to one of the two study groups, group I (Dexmedetomidine) and group II(normal saline).

PATIENT CHARACTERISTICS ACROSS GROUP:

The demographic characteristics like age, weight, gender, ASA of the

study population were compared and results similar in both groups, with no statistically significant difference.

The mean age in group I (DEX) was 28.27 ± 7.31years, while in group II (NS) was 25.53 ± 7.3 years, which was comparable.

The mean weight in group I (DEX) was 56.33 ± 5.54 Kg, while in group II (NS) was 57.63 ± 4.9 kg, which was comparable.

Group I (DEX) had 17 males and 13 females while group II (NS) had 18 males and 12 females hence statistically comparable.

Group I (DEX) had 12 patients of ASA I status and 18 patients of ASA II status. Group II (NS) had 14 patients of ASA I status and 16 patients of ASA II, results were compared and statistically insignificant, hence comparable.

CONCLUSION:

From the study it can be concluded that dexmedetomidine infusion at 0.5mcg/kg/hour infusion during general anaesthesia in middle ear surgeries,

1 .Reduces bleeding at surgical site and provides better visibility of the operative field under microscope than placebo.

2. Dexmedetomidine infusion reduces the requirement of sevoflurane to attain controlled hypotension.

3. Dexmedetomidine infusion helps to achieve the target controlled hypotension faster than with sevoflurane alone.

4. No adverse effects were observed.

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