



DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDE OLIGAEMIC SURGICAL FIELD: PROSPECTIVE STUDY

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ABSTRACT

As ENT surgeries are done in a small working space on small structures which needs a bloodless field or field with minimum bleeding. This can reduce the duration of surgery and can give better results. So, bloodless field can be achieved with various methods. In our study, we tried dexmedetomidine to control intra operative blood pressure which in turn can reduce the amount of blood loss and can give a clear field for surgery. Excessive reduction in blood pressure can cause adverse effects hence, careful monitoring is needed. A total of 60 subjects were selected and randomized into two groups namely DEX and NS with 30 in each group. DEX group subjects were given received infusion of dexmedetomidine 0.5 mcg/kg/hour after induction of anaesthesia till 20 minutes before completion of surgery. NS group received placebo infusion of normal saline 100 ml after induction of anaesthesia till 20 minutes before completion of surgery. Inter operative bleeding was graded with grading scale. Results were analyzed using suitable statistical tools and the results showed a better heart rate, systolic, diastolic and mean arterial pressure control, less bleeding during surgery with better surgical field, reduce duration of surgery, less sevoflurane requirement in DEX group.

KEYWORDS : Dexmedetomidine, blood pressure control, bloodless field, reduced surgical time

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 visualisation. This bloodless field is achieved through controlled or deliberate hypotension. Controlled or deliberate hypotension can be achieved through multiple modalities. Pharmacological and non pharmacological means can be used to achieve controlled hypotension.

Dexmedetomidine, a centrally acting alpha 2 agonist is being used in many countries since many years. 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.

OBJECTIVES:

1. To study the effect of dexmedetomidine on surgical blood loss and hence on the duration of surgery.
2. To study the effect of dexmedetomidine on time to achieve target blood pressure in controlled hypotension.
3. To study the effect of dexmedetomidine on sevoflurane requirements during anaesthesia.

MECHANISM OF ACTION:

Dexmedetomidine is an imidazole compound, active dextro isomer of medetomidine that shows selective and specific agonism to alpha 2 receptors. Neuronal hyperpolarization is the key action of alpha 2 agonists. Thus, activation of alpha 2 receptors in the brain and spinal cord inhibits neuronal firing and inhibits the release of nor epinephrine and terminates pain signals at presynaptic levels, postsynaptically at the CNS causes sympatholysis. A combined effect leads to hypotension, bradycardia, sedation and anxiolysis.

Highest densities of alpha 2 receptors are present in locus ceruleus, predominant norepinephric nucleus in the brain and an important modulator of vigilance, also important modulator of nociceptive neurotransmission. Hence inhibition of neuronal firing here produces analgesia and sedation.

Dexmedetomidine is a highly specific, selective and potent alpha 2 adrenergic agonist - 1,620:1 alpha 2: alpha 1.

MATERIALS AND METHODS:

This clinical study was conducted in Department of anaesthesiology, Thanjavur medical college in association with department of Oto-

rhino-laryngology during the period 2015-16. Clearance was obtained from hospital ethical committee for the study. This study was conducted on 60 adult patients planned to undergo middle ear surgeries were enrolled in this study. 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, weight 46-65 kg, 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, history of allergy to drugs or food.

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. Group I (DEX) received infusion of dexmedetomidine 0.5 mcg/kg/hour after induction 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 60% nitrous oxide with oxygen and 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. At any point MAP <50 mmHg was not allowed. 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:

DEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION:

Age distribution

In 30 patients of dexmedetomidine group the mean age was 28 years, while mean age was 26 years in 30 patients of normal saline group. Student 't' test was used to test the significance, p value was 0.152, which was <0.05. Hence, statistically insignificant.

Weight distribution

In 30 patients of dexmedetomidine group, the mean weight was 56 kilograms, while it was 58 kilograms in 30 patients of normal saline group. Student 't' test was used to test the significance, p value was 0.339 which was <0.05, hence weight distribution among both groups was statistically insignificant.

ASA status

Out of 30 patients of dexmedetomidine group, 12 patients belonged to ASA I status and 18 patients belonged to ASA II status. Out of 30 patients of normal saline group, 14 patients belonged to ASA I status and 16 patients belonged to ASA II status. Student't' test was used to test the significance, p value was 0.722 which was < 0.05, hence ASA status among both groups were not statistically significant.

Table 1: ASA status

S.No	GROUP	ASA I	ASA II	P value
1	GROUP I(DEX)	12	18	0.722
2	GROUP II(NS)	14	16	

Gender distribution:

Out of 30 patients in dexmedetomidine group, 17 patients were male and 13 patients were female. Out of 30 patients in normal saline group 18 patients were male and 12 patients were female. Fischer test was used to test the level of significance. p value was 0.301, which was <0.05, hence gender distribution is statistically not significant.

HAEMODYNAMIC PROFILE:

Baseline heart rate

Baseline heart rates in both the groups were compared. 30 patients of dexmedetomidine group had baseline mean heart rate of 85 beats per minute, 30 patients of normal saline group had baseline mean heart rate of 86 beats per minute. Unpaired t test was used to test the level of significance, p value was 0.521, hence baseline hear rate among both groups were statistically insignificant.

Intraoperative heart rate

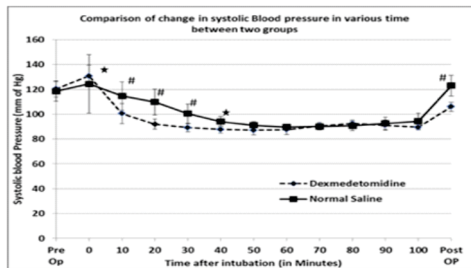
Table 2: Intraoperative heart rate

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
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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.

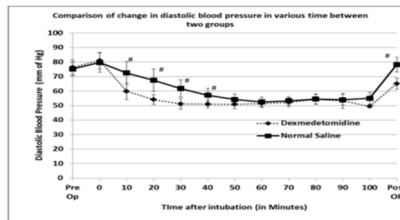
Systolic blood pressure



Graph 1: Comparison of change in systolic blood pressure between two groups

Preoperative systolic blood pressure comparison between dexmedetomidine and normal saline group was not significant. Systolic blood pressure from induction till 40 minutes intraoperatively shows statistical significance between two groups (p value < 0.05). systolic blood pressure from 50 minutes intraoperatively till 100 minutes shows no statistical significance between two groups. The 10 minutes post extubation systolic blood pressure was significantly lower in dexmedetomidine group than normal saline group, p value <0.0001. Two-way ANOVA with Tukey post hoc test was done for statistical significance

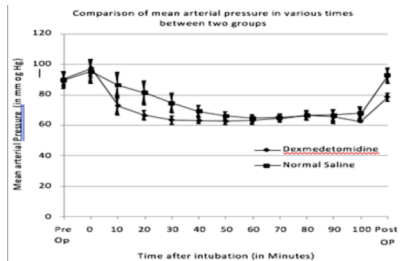
Diastolic blood pressure



Graph 2: Comparison of change in diastolic blood pressure between two groups

From graph of Comparison of change in Diastolic blood pressure between two groups, we can understand that, pre-operative diastolic blood pressures were comparable between two groups with no statistical significance. Diastolic blood pressure 10 minutes after induction till 40 minutes intraoperatively, dexmedetomidine group shows significantly lower diastolic blood pressure than normal saline group with p value <0.0001. 10 minutes post extubation value was significantly lower with dexmedetomidine group than normal saline group with p value <0.0001. Two-way ANOVA with Tukey post hoc test was done for statistical significance.

MEAN ARTERIAL PRESSURE



Graph 3: Comparison of mean arterial pressure in various times between two groups

From graph: 3, we can understand that Mean arterial pressure

preoperatively and at induction were not statistically significant between two groups. Mean arterial pressure from 10 minutes till 50 minutes intraoperatively shows statistical significance between two groups, with mean arterial pressure comparatively lower in dexmedetomidine group with a p value<0.0001. Mean arterial pressure from 60 minutes till 100 minutes intraoperatively shows no statistical significance in both the groups. The 10 minutes post extubation mean arterial pressure was significantly lower in dexmedetomidine group than normal saline group, pvalue<0.0001. Two-way ANOVA with Tukey post hoc test was done for statistical significance.

Sevoflurane requirement

Table 3: Sevoflurane requirement to reach target blood pressure:

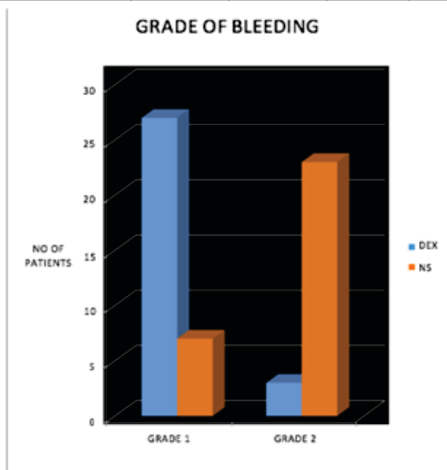
S. No	Group name (n=30/group)	Percentage of sevoflurane (MEAN±SD)	p value
1	GROUP I(DEX)	0.72±0.13	<0.0001
2	GROUP II(NS)	1.43±0.32	

The sevoflurane requirements, to achieve and maintain controlled hypotension were analysed. 30 patients of dexmedetomidine group required sevoflurane dial concentration ranging from 0.69% to 0.85%. 30 patients of normal saline group required sevoflurane dial concentration ranging from 1.11% to 1.75%. 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.

Grade of bleeding

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%)		



Graph 4:Grade of bleeding

Out of 30 patients of dexmedetomidine group, 27 patients had grade 1bleeding (minimal bleeding with sporadic suctioning), remaining 3 patients had grade 2 bleeding (repeated suctioning needed). Out of 30 patients of normal saline group, 7 patients had grade 1 bleeding (minimal bleeding with sporadic suctioning) 23 other patients had higher bleeding grade of 2. The results were compared. Chi square tests for proportions was used to test the level of significance (p value<0.0001), hence significant. Thus patients of dexmedetomidine group had statistically significant lower grade of bleeding than normal saline group.

Time taken to achieve target blood pressure

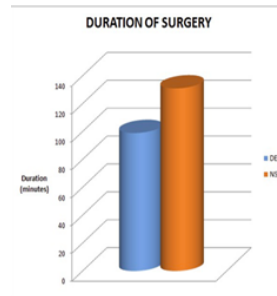
Time taken to achieve target blood pressure less than 30% of baseline systolic blood pressure or mean arterial pressure whichever was higher, were compared between two groups. Patients of dexmedetomidine group took an average of 24 minutes to reach target blood pressure, while patients of normal saline group took 48 minutes

to reach target blood pressure. The results were compared. Mann-Whitney U test was used to test the level of significance (U=26) 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.

Duration of surgery

Table 5: 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		



Graph 5:Duration of surgery

The average duration of surgery in 30 patients of dexmedetomidine group were 99 minutes. The average duration of duration of surgery in 30 patients of normal saline group were 131 minutes. The results were compared. Student t test was used to test the level of significance (t=8.99) p value was <0.0001, hence statistically significant. The duration of surgery was significantly lower in dexmedetomidine group than normal saline group.

DISCUSSION:

We conducted a prospective, double blinded randomized controlled study in 60 patients belonging to ASA I and II physical status undergoing elective middle ear surgeries in department of Oto-rhino laryngology, Thanjavur medical college hospital, Thanjavur. Patients of both sexes ranging between 18-45 years were included in our study. Our aim was to study the effect of dexmedetomidine in middle ear surgeries during general anaesthesia to provide bloodless surgical field.

Ethical committee approval was obtained. Informed written consent was obtained from patients. Patients were divided into two groups of 30 each randomly by closed cover technique. Baseline vital parameters were measured. Group I (DEX) received infusion of dexmedetomidine at 0.5mcg/kg/hour in 100 ml normal saline after induction till 20 mins prior to end of surgery. Group II (NS) received a placebo of 100 ml normal saline infusion after induction till 20 mins prior to end of surgery.

Intraoperative heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, sevoflurane dial concentration was measured at 10 mins interval throughout the surgery. Post-operative vitals parameters at the end of 10 minutes post extubation were recorded. Grade of bleeding was assessed by surgeon at the end of the surgery in a graded scale.

The obtained data were entered in Microsoft excel and statistical analysis done using SPSS (version 20). The demographic data were comparable between two groups. Categorical data was analyzed using student't' test and expressed in mean±S.D. Nominal variables were analysed using fischer test. Data were not statistically significant. In our study we observed that the baseline heart rate was comparable between two groups while intraoperatively heart rate was significantly lower in dexmedetomidine group than normal saline group (p <0.0001). Data are expressed as mean ± SD. Two-way ANOVA with bonferroni post hoc test was performed for the statistical significance.

Our aim was not to compare the systolic, diastolic blood pressure and mean arterial pressure in both groups. Time taken to attain the target blood pressure and sevoflurane requirements to attain target blood pressure were our factors of interest. Target blood pressures were achieved in both groups but there were intraoperative significant differences in both the groups from 10-50 minutes of the procedure.

This difference could be possibly because of the time taken by each group to attain the target hypotensive blood pressure.

The time taken to achieve the target blood pressure was significantly lower in dexmedetomidine group than normal saline group. The values were expressed as mean±S.D, Mann Whitney U test was used to test the level of significance (p value <0.0001). Hence statistically significant.+

The requirements of sevoflurane to achieve target blood pressure in both groups were compared. Dexmedetomidine group required 0.72±0.13% dial concentration of sevoflurane to achieve target blood pressure, while normal saline group required 1.43±0.32% dial concentration of sevoflurane to achieve target blood pressure. Data are expressed as mean ± SD. Unpaired student 't' test was used to test the level of significance and p<0.05 is considered statistically significant. The t value obtained was 4.669 and p value was <0.0001 and hence statistically significant. Dexmedetomidine infusion reduces the requirement of volatile agent (sevoflurane) to reach target blood pressure.

The bleeding of surgical site was graded and assessed by surgeon at the end of the surgery. Out of 30 patients in dexmedetomidine group, 27 patients had grade 1 bleeding and of them had grade 2 bleeding. But among 30 patients in normal saline group only 7 patients had grade 1 bleeding while 23 patients had grade 2 bleeding. Chi square test for proportions was used to analyze the data and p value was <0.0001, hence significant. Thus, it shows dexmedetomidine infusion reduces the bleeding at surgical site and provides better visibility of the operative field.

The duration of surgery in dexmedetomidine group was 99.01±0.01 minutes, while in normal saline group was 131.7±2.99 minutes. Student t test was used to test the level of significance. p value was <0.0001, hence significant. But the lesser duration of surgery cannot be attributed only to dexmedetomidine or better surgical field as it is dependent on multiple factors. No adverse effects were observed. No incidence of bradycardia requiring intervention with atropine was observed.

LIMITATIONS:

1. Only haemodynamic parameters were assessed under the study. Postoperative sedation and awakening time were not compared.
2. Duration of surgery was not completely reliable as it is not dependent only on bleeding at surgical site.
3. Cost effectiveness of dexmedetomidine was not analyzed.

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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