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Comparative Study of Hemodynamics, Postoperative Nausea and Vomiting in Middle Ear Surgeries with Desflurane and Sevoflurane

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Abstract

Introduction: Middle ear surgeries as such are associated with PONV and when inhaled anesthetics are used in these surgeries, the incidence of PONV might vary. Achieving a more effective outcome with respect to PONV will become increasingly important in the future as a result of increasing pressure to decrease discharge times. *Aims:* To compare the intra-operative hemodynamic parameters along with postoperative nausea and vomiting with Desflurane and Sevoflurane in Middle Ear Surgeries. *Materials and methods:* The present study was a prospective, randomized, comparative clinical study, was conducted in patients scheduled to undergo elective middle ear surgeries in 60 patients, planned for elective middle ear surgeries under general anesthesia. Patients between the age of 12 and 60 are selected for the study comprising of both sexes. They are divided into 2 groups randomly, Group S (Sevoflurane) and Group D (Desflurane); 30 patients in each group. *Results:* The difference in average preoperative systolic, diastolic blood pressure, heart rate was statistically not significant when compared in both groups. There was no statistically significant difference ($p > 0.05$) between the two groups with respect to PONV as Fisher's exact test statistic value is 1. *Conclusion:* No significant difference was found in terms of intra-operative hemodynamics and postoperative nausea and vomiting in patients receiving general anesthesia with sevoflurane and desflurane as inhalational agents for Middle ear surgeries.

Keywords: Middle Ear Surgeries, Desflurane and Sevoflurane

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Introduction

Middle ear surgeries are one of the most commonly performed ear procedures. Introduction of ossicular chain repairs and cochlear implantations for hearing defects has opened doors for further advances in these surgeries. The quest for an ideal anesthetic agent, which subserves the otologic goals, has now ushered us into an era whereby, sevoflurane and desflurane have gained popularity, with which, maintainence of anesthesia has become more convenient and attained more stability in terms of patients' hemodynamic profile when compared to the older inhalational agents.

Middle ear surgeries as such are associated with PONV and when inhaled anesthetics are used in

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these surgeries, the incidence of PONV might vary. Achieving a more effective outcome with respect to PONV will become increasingly important in the future as a result of increasing pressure to decrease discharge times. In this study, effects of desflurane and sevoflurane as inhalation agents on intraoperative hemodynamic profile and PONV in Middle ear surgery is comparatively investigated.

Materials and Methods

The present study, a prospective, randomized, comparative clinical study, was conducted in patients scheduled to undergo elective Middle ear surgeries at Govt ENT hospital, Koti, Hyderabad. After approval from the Departmental ethics committee and written informed consent from the patients, a randomized control study was conducted on 60 patients, planned for elective Middle ear surgeries under general anesthesia.

Patients between the age of 12 and 60 are selected for the study comprising of both sexes. They are divided into 2 groups randomly, Group S (Sevoflurane) and Group D (Desflurane); 30 patients in each group.

Inclusion Criteria

1. ASA Grade I and II
2. 12 to 60 years of age
3. Who gave informed written consent
4. Patients scheduled to undergo elective Middle ear surgeries lasting from 60 min to 2 hours.

Exclusion Criteria

1. Patients who underwent general anesthesia in the past seven days
2. Patients with history of neuropsychiatric disorders
3. Pregnant, lactating and menstruating females
4. Baseline heart rate less than 60 bpm
5. Baseline blood pressure less than 100/50 mm Hg
6. Patients with BMI > 30
7. Patients with impaired hearing.

Preoperative assessment

All patients were pre operatively evaluated for surgery. All investigations were conducted before the surgery.

Investigations conducted are as follows:

Complete blood picture with platelet count

Complete urine examination

Random blood sugar, blood urea, serum creatinine, serum electrolytes

ECG, Chest X-ray, Neck X-ray

HIV, HbSAg

CT, BT

2D Echo

Patients were informed about the procedure in detail before commencing the operation and written consent was obtained.

Preparation of operating theater

Boyle's anesthesia machine was checked. Appropriate size endotracheal tubes, working laryngoscope with medium and large size blades, stylet, bougie and working suction apparatus were kept ready before the procedure. Emergency drug tray consists of atropine, adrenaline, mephenteramine, ephedrine and dopamine were kept ready.

Procedure

Patients shifted to OR table, monitors like NIBP, electrocardiogram (ECG), Pulse oximeter were applied. Base vitals were recorded, IV access was obtained on the forearm with No 20G IV cannula Ringer's lactate solution at 3 ml kg^{-1} was started.

Patients were premedicated with Glycopyrrolate 0.2 mg IV, ondansetron 4 mg IV, fentanyl 1–2 mcg/kg IV. Both the study groups received standard anesthetic technique with Propofol 2 mg/kg titrated to loss of verbal response. Endotracheal intubation was facilitated with Suxamethonium (1.5 mg/kg) and intubation done with suitable sized cuffed tube. All patients were mechanically ventilated with 33:66 O_2/N_2O mixtures. Respiratory rate (RR) and tidal volume (TV) were adjusted according to body weight to maintain normocapnia.

During the maintenance period, ventilation was controlled to maintain normocarbia using a closed circle system with a total fresh gas flow rate of 5 L/min with 66% N_2O and 33% O_2. Vecuronium was used during maintenance of anesthesia. Group S received Sevoflurane of 1–2% and Group D received Desflurane of 4–6% for maintainence of anesthesia.

The inhalational anesthetic was discontinued at the end of the procedure and N_2O was discontinued after the last skin suture was placed. After completion of surgery, oral suctioning was done. At the end of anesthesia, residual neuromuscular blockade was reversed using glycopyrrolate, 0.01 mg/kg IV, and neostigmine, 0.06 mg/kg IV. Intraoperative monitoring of hemodynamics was done.

The durations of anesthesia (from the start of induction to discontinuation of N_2O) and surgery (from surgical incision to skin closure) were also recorded. Monitoring included non-invasive blood pressure measurement, heart rate, and oxygen saturation. Hemodynamics were recorded preoperatively (baseline), intraoperatively (at intubation time, 5 min, 10 min, 15 min, 30 min and for every 30 min thereafter), until the completion of surgery. After extubation and full recovery, patients were transferred to the postanesthesia care unit (PACU).

In the postoperative period, the incidences of PONV were recorded within the first 24 hours after surgery. Episodes of PONV were identified by spontaneous complaints by the patients or by direct questioning. No distinction between nausea, vomiting and retching.

Statistical analysis

The data collected was entered into an Excel sheet. It was subjected to statistical analysis in MS Excel and SPSS v.16. Data was expressed in frequencies and percentages when qualitative and in Mean ± SD when quantitative. Unpaired Student *t*-test was used for comparing the trends for all parameters in the two groups. A '*p*' value of < 0.05 was considered significant.

Results

Sixty patients, undergoing Middle ear surgery, were selected for the study. The patients were randomly divided into two groups of 30 patients each.

The average age of Group S was 40.03 ± 12.04 and that of Group D was 37.36 ± 11.74. The youngest patient in the study group was 17 years and the oldest was 60 years. There was no statistically significant difference in age between the 2 groups. Total number of males in Group S are 18 whereas Group D has 16 males. Total number of females in Group S are 12 whereas Group D has 14 females. Total number of ASA-1 patients in Group S are 17 whereas Group D has 20 patients. Total number of ASA-2 patients in Group S are 13 whereas Group D has 10 patients (Table 1).

There was no statistically significant difference between the two groups in mean duration of surgery and mean duration of anesthesia (Fig. 1).

There was no statistically significant difference ($p > 0.05$) between the two groups in mean systolic BP (Fig. 2).

There was no statistically significant difference ($p > 0.05$) between the two groups in mean diastolic BP (Fig. 3).

Table 1: Demographic Distribution between Groups

	Group S		Group D	
	Number of patients	**Percentage**	**Number of patients**	**Percentage**
Age in Years				
12–20	2	6.66	2	6.66
21–30	5	16.66	7	23.33
31–40	6	20	9	30
41–50	11	36.66	8	26.66
51–60	6	20	4	13.33
Total	30	100	30	
Mean	40.03		37.36	
Sd	12.04		11.74	
p value = 0.388				
Sex				
Male	18	60	16	53.34
Female	12	40	14	46.66
Total	30	100	30	100
ASA				
I	17	56.66	20	66.66
II	13	43.34	10	33.34
Total	30	100	30	100

There was no statistically significant difference ($p > 0.05$) between the two groups in mean heart rate (Fig. 4).

There was no statistically significant difference ($p > 0.05$) between the two groups with respect to PONV as Fisher's exact test statistic value is 1 (Table 2).

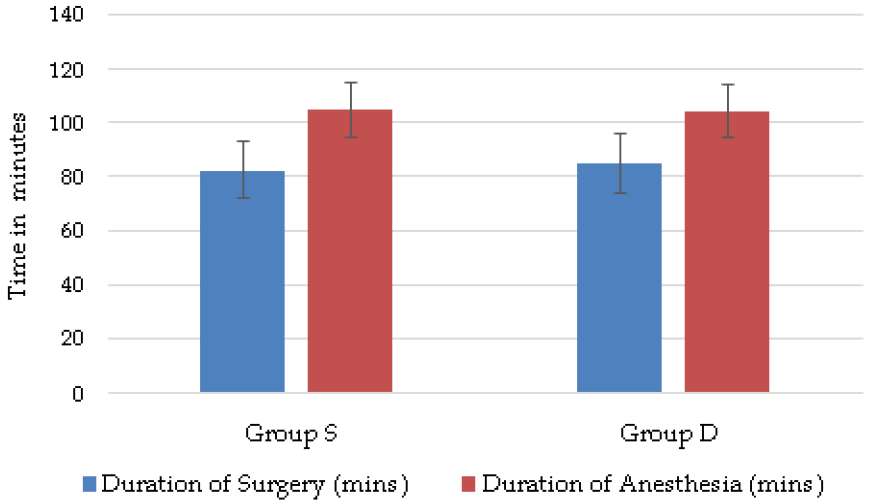

Fig. 1: Comparison of mean duration of Anesthesia and mean duration of Surgery of groups

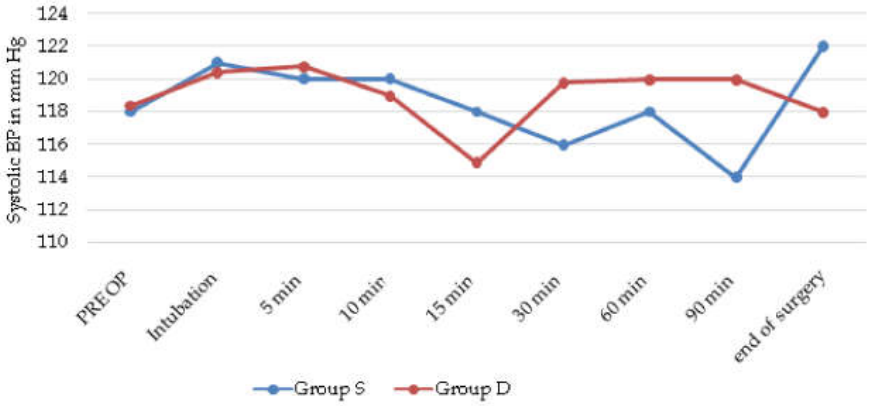

Fig. 2: Comparison of Systolic BP of groups

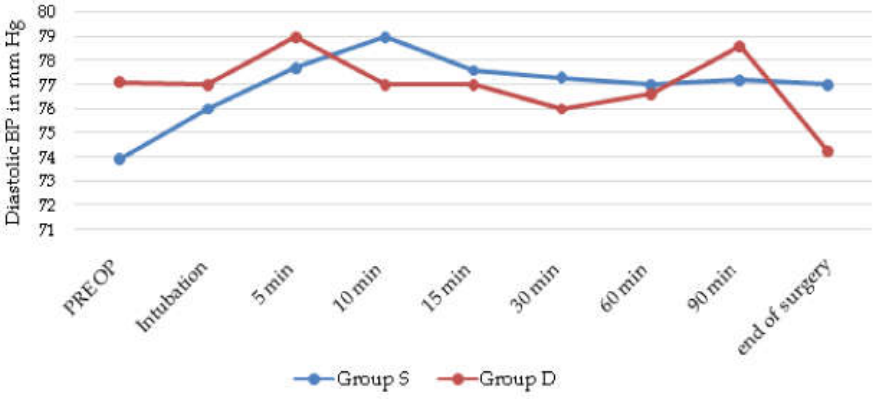

Fig. 3: Comparison of Diastolic BP between groups

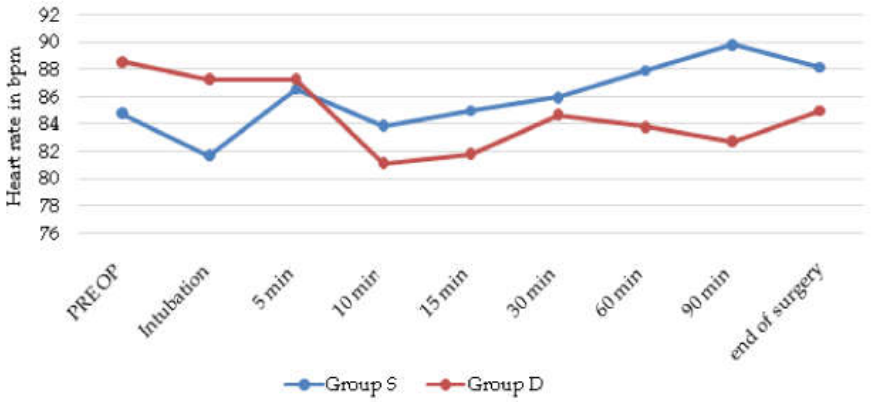

Fig. 4: Comparison of mean Heart rate between groups

Table 2: Comparison of PONV in first 24 Hrs in Groups

PONV	Group S		Group D	
	Number of cases	Percentages	Number of cases	Percentages
Yes	7	23.33	8	26.66
No	23	76.66	22	73.33
Total	30	100	30	100

Discussion

Middle ear surgeries requires a bloodless, motionless operative field, non-fluctuant hemodynamics, and a reduced incidence of postoperative morbidities especially nausea and vomiting (PONV). This study assesses intraoperative and perioperative outcomes (PONV) using Desflurane or Sevoflurane anesthesia for middle ear surgery. The quest for an ideal anesthetic agent, which subserves the otologic goals has now ushered us into an era whereby, sevoflurane and desflurane have gained popularity. The two anesthetic agents in our study appear to subserve the objectives of maintaining hemodynamic stability, providing adequate conditions.

Patients were selected between the age of 12 and 60. The Mean age was (Mean ± SD) 40.03 ± 12.04 in Group S and Mean age was 37.36 ± 11.74 in Group D. The difference was statistically insignificant ($p > 0.05$) i.e ($p = 0.38$). The difference in average preoperative heart rate was statistically not significant ($p = 0.27$). Preoperative mean pulse rate in Group S 84.8 ± 13.39 and in Group D 88.66 ± 13.55. The preoperative Systolic BP (SBP) in Group S 118.33 ± 11.13 and in Group D 118.4 ± 9.84 and differences were observed that there are statistically insignificant ($p > 0.05$) i.e. ($p = 0.98$).

The Preoperative Diastolic BP (DBP) in Group S 73.93 ± 6.79 and in Group D 77.13 ± 6.14 and differences were observed that there are statistically insignificant ($p > 0.05$) i.e. ($p = 0.06$).

All patients were followed in the intraoperative period for hemodynamics (heart rate, SBP and DBP). Recordings were done during intubation, at the intervals of 5, 10, 15, 30 min and every 30 min thereafter intraoperatively.

Mayur Patel *et al.*[1] compared intraoperative hemodynamic profile of desflurane and sevoflurane as maintenance anesthetic in patients undergoing day care gynecological laparoscopic surgery. A prospective randomized single-blind study was conducted in 100 female patients belonging to the American Society of Anesthesiologists grade I or II. Patients were randomized into two groups to receive either desflurane (Group D; $n = 50$) or sevoflurane (Group S; $n = 50$) for maintenance of anesthesia.

Mayur Patel *et al.*[1] based on the above parameters, reported that intraoperative hemodynamic parameters are similar in both desflurane and sevoflurane anesthesia which is in concordance with our study.

Fraga *et al.*[2] compared the MAP, ICP, and cerebral perfusion pressure (CPP) using 1 MAC of either isoflurane or desflurane (with 60% N_2O) in normocapneic patients undergoing craniotomy for supratentorial brain tumors. The ICP measurements throughout the study did not change within each group compared with baseline values and they did not find any significant difference of MAP, ICP, and CPP between the two groups. Our study results have shown that the hemodynamic parameters in both the groups were comparable similar to the

results of the above study and we did not include measurement of ICP in this study.

Sponheim *et al*.[3] reported a dose-dependent and clinically similar increase ICP and reduced MAP with $p < 0.001$ and CPP at 0.5 and 1.0 MAC of isoflurane, sevoflurane and desflurane in N_2O (60%) in hypocapneic children of study population of 36 divided into 3 groups of 12 each. They concluded that 0.5 and 1.0 MAC of isoflurane, sevoflurane and desflurane in N_2O all increased ICP and reduced MAP and CPP in a dose dependant manner. In our study, SBP and DBP values (indicating MAP) between the two groups were not statistically significant and we did not compare the effect on ICP.

White *et al*.[4] studied the hemodynamics, emergence, and recovery characteristics of sevoflurane with those of desflurane in nitrous oxide anesthesia and concluded that the groups did not differ in these hemodynamic measures. Findings in our study are consistent with the above study.

The current findings are consistent with previously published comparative study conducted by Heavner *et al*.[5] demonstrating that sevoflurane and desflurane provided similar intraoperative conditions during the maintenance period. The study by Nathanson *et al*.[6] suggested that sevoflurane and desflurane provided similar intraoperative conditions during the maintenance period. Although early recovery was faster with desflurane, there was no difference in the intermediate recovery end points. Gergin *et al*.[7] concluded intraoperative cardiovascular stability was easily achieved with both sevoflurane and desflurane, with MAP and HR maintained at ± 20% baseline values during the maintenance period. Although HR reduced below baseline values, reduction was less in desflurane group.

In conclusion, desflurane like sevoflurane maintains hemodynamic stability during intraop period. Although duration of anesthesia was longer early recovery profile was rapid in desflurane group. In our study, though a fall in heart rate with desflurane was not much appreciable, heart rate between Group S and Group D remained comparable. SBP and DBP (indicating MAP) values along with HR showed no statistical significance.

All patients were followed postoperatively for PONV during the first 24 hours. There was no statistically significant difference ($p > 0.05$) between the two groups with respect to PONV as Fisher's exact test statistic value is 1. Gupta *et al*.[8] did systemic analysis of recovery after ambulatory surgery comparing isoflurane, sevoflurane, and desflurane with a conclusion that early recovery and time to obey was significantly less with desflurane when compared to sevoflurane and isoflurane. They also observed that time to home readiness was 5 min earlier with sevoflurane as compared to isoflurane and other parameters such as pain, N/V were comparable.

Our study showed similar results, except that we did not compare recovery parameters.

The incidence of postoperative nausea and vomiting was similar in both the groups, consistent with the study by Kim *et al*.[9] who also found that late recovery profiles and incidences of postoperative side effects were similar after desflurane and sevoflurane. Our study was in concordance with this study.

Conclusion

This study was conducted to compare the intraoperative hemodynamics and postoperative nausea and vomiting in patients undergoing Middle ear surgeries in general anesthesia with a sevoflurane/desflurane based technique.

Intraoperative hemodynamics in these patients was studied in relation to variables like Heart rate, Systolic blood pressure and Diastolic blood pressure along with presence/absence of postoperative nausea and vomiting in 24 hrs. Concluded no significant difference was found in terms of intraoperative hemodynamics and postoperative nausea and vomiting in patients receiving general anesthesia with sevoflurane and desflurane as inhalational agents for Middle ear surgeries.

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