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Research Article

A Comparison of Emergence Behaviour and Cost Effectiveness in Tonsillectomy Patients Undergoing General Anaesthesia with Desflurane versus Sevoflurane

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ABSTRACT

Background: It has been seen that volatile anaesthetics agents which are speedily eliminated with minimal breakdown should facilitate faster recovery from general anaesthesia. As compared to isoflurane-based anaesthesia, both sevoflurane and desflurane have shorter emergence times due to rapid induction and elimination.
Aim: The aim of this study is to compare and analyse the superiority of both agents, with regards to the emergence and recovery from anaesthesia, intraoperative hemodynamics, postoperative side effects and estimate the average quantity and cost-benefit of both volatile agents consumed.
Methods: Total of 100 cases above the age of 6 years undergoing tonsillectomy surgeries of ASA grade 1& 2 was included. Patients were allocated into two groups by computer-generated numbers. Group S: Anaesthesia maintained with 50/50 mixture of nitrous oxide/oxygen and sevoflurane. Group D: Anaesthesia maintained with 50/50 mixture of nitrous oxide/oxygen and desflurane. The parameters recorded were compared between the two groups using the unpaired t-test for continuous variables and $P \leq 0.005$ is deemed significant.
Results: There was no significant hemodynamic difference intraoperatively between sevoflurane and desflurane except in the desflurane group, heart rate was higher. Recovery was faster and better in Group D.
Conclusion: Postoperative recovery was better and faster and postoperative complication was lower in the desflurane group. Though the total cost of desflurane group was higher compared to sevoflurane but the use of desflurane can be justified with lesser complication, faster emergence from anaesthesia, faster shifting from PACU, lesser hospital stays, lower chance of nosocomial infection and lower cost of hospital stay.

It has been seen that the volatile anaesthetics agents which are speedily eliminated with minimal breakdown should facilitate faster recovery from general anaesthesia. As compared to isoflurane-based anaesthesia, both sevoflurane and desflurane have shorter emergence times due to rapid induction and elimination [1]. Emergence from anaesthesia was more rapid after desflurane compared to
sevoflurane [2].
Characteristics required to make an anaesthetic agent an ideal one for ambulatory patients should provide rapid and smooth induction, rapid recovery with low incidence of nausea, vomiting, bleeding, postoperative pain and

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should provide optimal operating conditions [3]. Inhaled anaesthetics agents permit early recovery from anaesthesia because of easy titrability with inherent neuromuscular blocking effects [4]. Sevoflurane and Desflurane allow faster induction and emergence from anaesthesia compared to traditional inhalation anaesthetics due to the low blood: gas partition coefficient. Sevoflurane (blood: gas partition coefficient of 0.65 and fat: blood solubility 48 at 37°C), desflurane (blood: gas partition coefficient of 0.42 and fat: blood solubility 27 at 37°C), [5].

Methods

A prospective, randomized, and comparative study was conducted after approval from Institutional Ethics Committee and written informed consent from patients at a tertiary care hospital on 100 patients of ASA physical status 1 and 2, age above 6 years, of both sex undergoing elective tonsillectomy under general anaesthesia. Patients with history of allergy to sevoflurane or desflurane, history of neuropsychiatric disorder, known case of bronchial asthma, hepato-renal dysfunction, with history of alcohol consumption. morbid obesity, a metabolic or endocrine disorder, family history or personal history of neuromuscular dystrophy were excluded from the study. 100 patients were allocated in 2 groups by computer-generated numbers. (n=50) Group S: Anesthesia maintained with 50/50 mixture of nitrous oxide/oxygen and sevoflurane. Group D: Anaesthesia maintained with 50/50 mixture of nitrous oxide/oxygen and desflurane. For elimination of bias in the study double blinding (patient and observer) was done. All the patients underwent a pre-anaesthetic check-up before surgery and all the routine and specific investigations were documented. The patients were kept nil per oral for 6 hours before surgery. In the operation theatre, standard monitors like ECG, NIBP, and pulse oximeter were applied to patients and patients' baseline parameters i.e. pulse blood pressure, respiratory rate, spO2 etc were recorded. Nasal preparation was done with vasopressor xylometazoline 0.5%. An intravenous line was secure and premedicated with Inj.Glycopyrrolate (4mcg/kg), Inj.Onadansetron (80mcg/kg), Inj. Ranitidine (1 mg/kg), Inj Fentanyl (1 mcg/kg) Intra-venous route.

All patients were pre oxygenated before induction of anaesthesia. Anaesthesia was induced with sodium thiopentone 6mg/kg and succinylcholine 1.5mg/kg intravenously. After the loss of consciousness, ventilation of the lungs was manually assisted and the airway was secured with a nasal endotracheal tube and throat packing done. The patients subsequently received either sevoflurane 1–2% (Group S) or desflurane 3–6% (Group D) with 50% nitrous oxide in oxygen. Rescue bolus doses of metoprolol 0.1mg/kg were administered to control acute hemodynamic changes not responding to a 50% increase in inspired concentration of the volatile anaesthetic agent. Muscle relaxation was maintained using intermittent doses of vecuronium bromide at appropriate intervals, based on TOF scoring by PNS.

Reversal was done within glycopyrrolate 0.08mg/kg and in neostigmine 0.05mg/kg. Extubation was done after the criteria for extubation were met. After the closure of inhalational recovery parameters was assessed as time to eye-opening, time to respond to verbal command, to extubation, modified Aldrete's score at the time of shifting to recovery.

Statistical analysis

The parameters recorded were entered on a computer and compared between the two groups using a paired t-test for continuous variables and $P \leq 0.005$ is deemed significant.

Results

Figure 1- Heart rate measurement

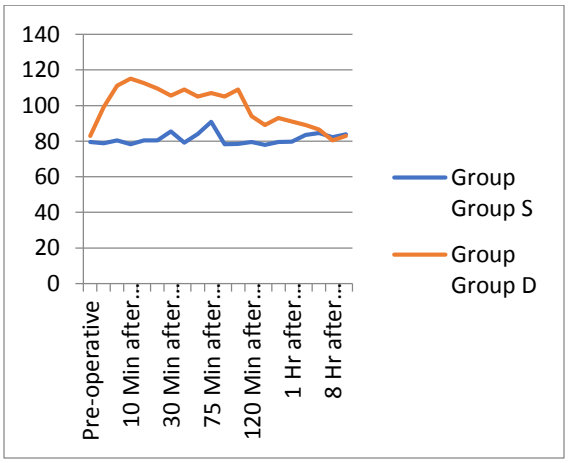
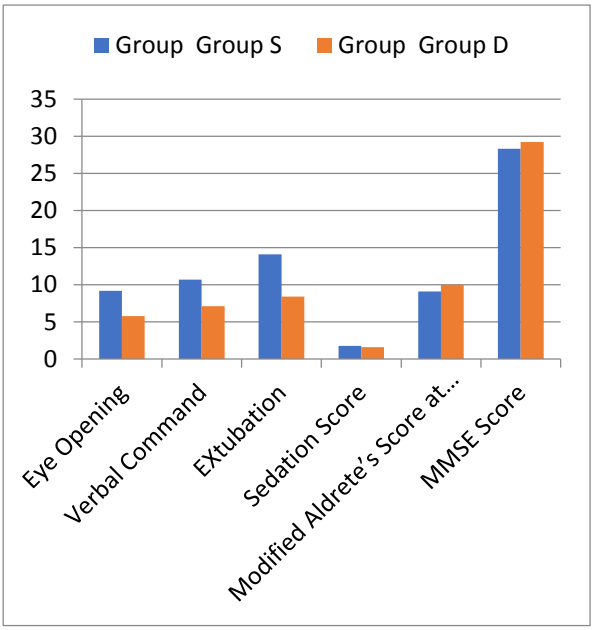


Table 1- Mean blood pressure measurement

	Group S	Group D	95% CI of difference	P value	Significance
Pre-operative	87.8±4.8	85.4±5.1	3.81 to 9.78	0.017	S
Immediately after induction	90.4±5.2	89.1±6.4	-1.04 to 3.614	0.26	NS
5 Min after induction	90±5.4	92.4±6.4	-4.76 to -0.039	0.046	NS
10 Min after induction	89.7±5.2	90.6±5.2	-2.84 to 1.04	0.104	NS

15 Min after induction	91±4.6	93±5	-3.91 to -0.08	0.04	NS
20 Min after induction	91±4.8	93.7±5	-4.607 to -0.79	0.311	NS
30 Min after induction	88.9±4.5	94.3±5	-7.28 to -3.51	0.0001	S
45 Min after induction	90.1±5.4	92.3±5	-4.26 to -0.135	0.037	NS
60 Min after induction	90.9±6	95±5	-6.2 to -1.9	0.003	S
75 Min after induction	90.8±5.6	91.7±5	-3.007 to – 1.207	0.398	NS
90 Min after induction	90.3±4.5	91.9±4.6	-3.40 to -0.20	0.081	NS
105 Min after induction	89.5±7.1	89.9±5	-2.83 to 2.03	0.745	NS
120 Min after induction	89.8±4.8	89.1±6	13.36 to 16.8	0.52	NS
Just after Extubation	89.7±5.1	81.8±6.4	5.60 to 10.19	0.0001	HS
30 Min after Extubation	85.7±6	84.4±6.4	-1.162 to 3.762	0.297	NS

Figure 2- Post-operative cognitive functions recovery



Discussion

The present study compared the use of desflurane and sevoflurane in tonsillectomy surgery emergence behaviour and cost-effectiveness.

In our study, Both the groups were comparable concerning age, weight, ASA grade I/II and duration of surgery. There was no significant difference in heart rate among both the group before induction and 2 hours post-extubation. The heart rate increased in group D with the maximum increase in heart rate 109.6±8.2 was seen 20 min after induction and group S maximum heart rate was 90.8±5.6 at 75 min after induction. Similar to our study, Nathanson MH et al2 studied Intraoperative cardiovascular stability was easily achieved with both sevoflurane and desflurane, with MAP and HR maintained within +/- 20% of baseline values during the entire maintenance period for patients scheduled for laparoscopic tubal ligation procedures who received either Sevoflurane or Desflurane.

Our study showed no significant difference in mean blood pressure in both groups before induction. MBP difference was statistically significant between 30 minutes, 60 minutes after induction and just after extubation, 1 and 2 hours after extubation. In one study, Jindal et al1 showed no statistical difference in the intraoperative HR and MAP between the groups which received Desflurane and Sevoflurane for outpatient anaesthesia. The emergence and recovery time was shorter after the maintenance of anaesthesia with Desflurane.

There was a significant difference in Postoperative cognitive functions recovery among both the groups in our study. The mean eye-opening in Group S was 9.2±1.1 minutes and in Group D 5.8±0.9 minutes. Meantime to follow verbal command in Group S was 10.7±1 minute and in Group D 7.1±0.9. minutes. The mean time to extubation in Group S was 14.1±1.2 minutes and Group D was 8.4±0.9 minutes. Recovery was faster and better in Group D. Modified Aldrete's score and MMSE (Mini-Mental State Examination) score at was higher in Group D.

Similar to our study, Naidu-Sjosvard K et al [6] studied 50 patients who underwent arthroscopy procedures using Desflurane or Sevoflurane and found out that the time to open eyes and the time to obey commands was better with Desflurane.

Kim JM et al [7] studied the effect of Desflurane and Sevoflurane on children and showed Emergence and recovery from anaesthesia were significantly faster in the Desflurane group.

In one meta-analysis, Gupta et al [8] found no significant differences between Desflurane and Sevoflurane groups in recovery indices.

In Group S, the incidence of nausea was 3, vomiting was 2, coughing was 1. There was no requirement for metoprolol. In Group D, the incidence of nausea was 5,

vomiting was 2, coughing was 3. There was 4 times requirement of metoprolol in Group D.

Jindal et al [1] studied the incidence of postoperative complications including nausea, vomiting, drowsiness, sore throat, headache and respiratory complications were similar in both the group which received Desflurane and Sevoflurane for outpatient anaesthesia

Arian SR et al [9] demonstrated that when airway responses to Desflurane and Sevoflurane were compared in elective surgical patients breathing through an LMA, there were significant adverse responses with Desflurane when higher concentrations of volatiles were used. Compared with equipotent concentrations of Desflurane, Sevoflurane was associated with substantially fewer adverse movements and airway effects.

Our study showed a significant difference in the cost-benefit ratio among both groups. In Group S, the Total mean volume of inhalational agents was 22.2±2 ml and the mean cost was Rs. 666.3±61. In Group D, the Total mean volume of inhalational agents was 42.0±3.8 ml and the mean cost was Rs.1514±139.2

In one clinical trial, Tas B A et al [10] found the amount and cost of the volatile anaesthetic consumed were higher in the desflurane group for Comparison of minimal-flow sevoflurane versus desflurane anaesthesia

Conclusion

There was no significant hemodynamic difference intraoperatively between sevoflurane and desflurane except HR was higher in the desflurane group. Post-operative recovery was better and faster with desflurane. The postoperative complication was lower in the desflurane group. Though the total cost of the inhalational agent in the desflurane group was higher compared to sevoflurane but the use of desflurane can be justified with lesser complication, faster emergence from anaesthesia, faster shifting from PACU and earlier discharge which will lead to a lesser hospital stay, lower chance of nosocomial infection and lower cost of hospital stay.

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