Original Research Article

Comparison of induction and recovery characteristics of Propofol and Sevoflurane in daycare adult tonsillectomies

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Abstract

Background: Ambulatory anesthesia is a rapidly growing subspecialty. Although its history is as old as the history of general anesthesia itself, it has emerged as a recognized concept and is evolving over the past couple of decades. Propofol and sevoflurane have increased the ability of the anesthesiologist to provide a successful daycare experience.

Aim: To compare the induction and recovery characteristics of propofol and sevoflurane by, the time to loss of consciousness, incidence of apnoea, induction complications, recovery time and incidence of postoperative nausea, vomiting, and pain when they are used as sole induction and maintenance anaesthetic agents in adult tonsillectomies.

Materials and methods: A total of 40 patients scheduled for tonsillectomy were selected. Each patient was randomly allocated to either the propofol or the sevoflurane group by lots. All the patients received glycopyrrolate 5 mcg/kg IV and fentanyl, 2 mcg/kg IV just before induction of anesthesia. Propofol group patients received propofol 2 mg/kg IV and intubated with 1.5 mg/kg succinylcholine IV. Sevoflurane group patients induced with sevoflurane 4% by patient-controlled inhalation induction and intubated with 1.5 mg/kg succinylcholine IV. The characteristics were compared by assessing the time to loss of consciousness, induction complications such as desaturation, coughing, laryngospasm and patient movement, the incidence of apnoea, time of Phase 1 and Phase 2 recovery.

Results: Induction with sevoflurane was slower than propofol. The incidence of apnoea was equal in both groups. Phase 1 and 2 recovery times were comparable between both the groups. Sevoflurane

anesthesia was associated with high Postoperative Nausea and Vomiting (PONV) and postoperative pain rate which is statistically not significant.

Conclusion: The smoother induction and less postoperative PONV with propofol make it an ideal anaesthetic agent than sevoflurane for induction and maintenance of anesthesia in adult outpatient surgeries.

Key words

Propofol, Sevoflurane, Loss of consciousness, Apnoea, PONV, Phase 1 and Phase 2 recovery, Laryngospasm.

Introduction

The outpatient surgery has grown at an exponential rate progressing from the practice of performing simple procedures on healthy outpatients to encompassing a broad spectrum of patient care in free-standing ambulatory surgery centres [1]. The surgery may be done in a hospital, a freestanding surgery centre or in some cases in the surgeon's office, anesthesia care is given or supervised by the anesthesiologist [2]. The advantages of lower cost, a lower rate of hospital-acquired infections, fewer separations of patients from their home and family environment, less patient anxiety and greater patient convenience have been demonstrated by this subspecialty over a period of five decades [3]. Patients save money by less pre-operative lab tests and fewer post-operative medications and by recovering at home. They are continued to be employed while recuperating, thus beds are free for the hospital for sicker patients and for emergency surgeries [4]. Patients have greater flexibility in selecting the time of their operation [5]. Newer anesthetic drugs allow the patient to recover faster, permitting the number and complexity cases to include longer and more complex procedures permitting a safer operation theatre without flammable anesthetics (appropriate pain management and prophylaxis for PONV is included as part of discharge planning). Technology has offered sophisticated monitors to monitor patients [6]. More carefully during anesthesia, thus permitting sicker patient with more challenging medical conditions to be considered for ambulatory anesthesia [7]. There are several types of anesthetic techniques available for ambulatory surgery ranging from local anesthesia to general anesthesia. The anesthetic technique recommended depends on several factors like the surgical procedure, the medical history of the patient and the patient preference [8]. General anesthesia with regional anesthesia for postoperative pain relief is an ideal combination as it combines the advantages of both the comfort and lack of awareness in the former and the good quality of pain relief with the later. Anesthetic agents today have been designed and marketed to meet the specific niche of ambulatory anesthesia [9, 10].

Materials and methods

Totally 40 patients scheduled for tonsillectomy was selected. The study was carried out in the Department of Otorhinolaryngology in Madras Medical College and Hospital, Chennai in 2007. Preoperative assessment of the patient was done by history regarding systemic disorders such as hypertension, diabetes mellitus, ischemic heart disease, and congestive cardiac failure, was taken. A thorough examination of the cardiovascular system, respiratory system, airway assessment was done. Informed written consent was obtained. A good rapport was developed with patients and was explained about the procedure involved. The entire patient's age ranged from 13 to 40 years. Patients were shifted to the operating table, and they were made to lie in the supine position. Monitors like pulse oximetry, NIBP and ECG were connected. Baseline values of Pulse rate, SPO_2 and NIBP (Non-invasive blood pressure) were recorded. An intravenous infusion was started in the non-dominant arm. The patients were not given any intramuscular premedication. No prophylactic

antiemetic was given. All the patients received glycopyrrolate 5 mcg/kg and fentanyl 2 mcg/kg just before induction of anesthesia. Lignocaine 2% IV 1cc was given before induction to both the groups. Although lignocaine was given as prophylaxis against pain on injection of propofol, it was administered to both groups of patients because of possible effects on hemodynamic variables and to make it a constant. In the propofol group, the patients were induced with propofol 2mg/kg IV and intubated with 1.5mg/kg IV succinylcholine. After confirming and securing the endotracheal tube in the position they were connected to the closed circuit with nitrous oxide and oxygen in 2L:1L. Immediate post-intubation this group of patients received a continuous infusion of propofol 6 to 12 mg/kg /hr (100 to 200mcg/kg/minute) to maintain an adequate depth of anesthesia as judged by clinical signs and hemodynamic response to surgical stimuli. Ventilation was controlled with vecuronium 0.8mg/kg as the loading dose and 1/4th of the loading dose as top-up dose. They were given diclofenac injection IM after intubation. In the sevoflurane group, the patients were induced with sevoflurane 4% by patient-controlled inhalational induction i.e spontaneous ventilation (Penlon Sigma-Delta vaporizer) in nitrous oxide and oxygen in 4L:2L ratio and intubated with 1.5mg/kg of IV succinylcholine. After confirming and securing the endotracheal tube in position, they were connected to the closed circuit with nitrous oxide and oxygen in 2L:1L ratio with sevoflurane 1 to 2.5% to maintain adequate depth of anesthesia. Ventilation was controlled with vecuronium 0.8mg/kg as a loading dose and $1/4^{th}$ of loading dose as a top-up dose. This group also received diclofenac injection after intubation. Throughout the procedure heart rate, ECG and SPO_2 were monitored continuously and NIBP was monitored every five minutes. Upon completion of the surgery, the residual neuromuscular block was reversed with neostigmine 50mcg/kg and glycopyrrolate 10mcg/kg and then anesthesia was discontinued. The patient's lungs were ventilated with 100% oxygen at a flow rate 8L/minute until tracheal extubation. The time of discontinuing the agent was taken as, time zero, to calculate the recovery time.

Statistical analysis

The descriptive statistics of the variables studied were represented as two-way tables. The categorical factors were represented by the number and frequency (%) of cases. The continuous variables were represented by measures of central frequency (like mean, median) and deviation (standard deviation and range). The differences in the properties were tested for statistical significance using the non-parametric chi-square test for variables measured on a normal scale. For variables measured on a continuous scale, when testing two groups, students "t" test was used to test for statistical significance in the differences between the two means.

Results

The patients included in the study were divided into two groups consisting of twenty patients each. Group P received propofol anesthesia. Group S received sevoflurane anesthesia.

It was noticed that the mean age was observed to be greater in group P than Group S but statistically not significant. It was noted that a female preponderance was forthcoming in Group P and equally distributed in Group S. The difference in the distribution between the two groups is not statistically significant (**Table – 1**).

Table - 1: Distribution of age of cases by groups.

Age	Group P	Group S
No. of cases	20	20
Mean	20.4	17.6
S.D	7.59	7.92
Median	16.5	14
Range	13-38	12-40

It was noted that there were no differences in ASA between the two groups. All the cases in the study were identically classified as Grade 1 on ASA (**Table – 2**).

Table - 2: Distribution of cases by ASA and groups.

ASA	Group P (n=20)		Group S (n=20)		p-value
	No	%	No	%	
Grade 1	20	100	20	100	1.00
Others	0	0.0	0	0.0	

Table - 3: Distribution of cases by MPC and groups.

MPC	Group P (n=20)		Group S (n=20)		P-Value
	No	%	No	%	
Grade 1	16	80.0	19	95.0	0.34
Grade II	4	20.0	1	5.0	

Table - 4: Distribution of cases by groups and MAP.

MAP	Group P (N=20)		Group S (N=20)		p-value
	Actual	Difference from reference	Actual	Difference from reference	
PRE OP					
Mean	92.6	-	93.7	-	-
SD	9.42		8.38		
At INDUCTION					
Mean	80.6	-12.0	87.1	-6.6	0.12
SD	11.59	8.21	14.96	12.85	
POST OP					
Mean	92.8	0.25	92.9	-0.75	0.80
SD	9.47	10.56	13.01	13.56	
AT DISCHARGE					
Mean	88.0	-4.55	93.4	-0.30	0.07
SD	6.30	6.68	7.42	7.72	

Table - 5: Distribution of cases by groups and pulse rate.

Pulse rate	Group P		Group S		The p-value for difference of mean difference
	Actual	Difference from reference	Actual	Difference from reference	
PRE OP					
Mean	91.6	-	97.3	-	
SD	11.88		15.39		
At induction					
Mean	105.8	14.2	98.8	1.6	0.02
SD	11.52	10.85	25.19	21.34	
POST OP					
Mean	89.4	-2.25	99.5	2.25	0.39
SD	12.71	10.94	17.48	20.49	
At discharge					
Mean	87.4	-4.2	95.3	-2.0	0.57
SD	9.54	9.45	11.15	14.44	

Table - 6: Distribution of time to loss of consciousness (LOC) by groups.

Time to LOC	Group P	Group S	p-value
No. of cases	20	20	
Mean	39.8	71.6	
SD	17.13	26.28	**<0.001**
Median	35	75	
Range	20-90	20-140	

Table - 7: Distribution of cases by incidence of apnoea and group.

Apnoea	Group P (n=20)		Group S(n=20)		p-value
	No	%	No.	%	
No	2	0.0	2	10.0	**1.00**
Yes	18	90.0	18	90.0	

Table - 8: Distribution of phase one recovery by groups.

Phase one recovery profile	Group P	Group S
No. of cases	20	20
Mean	12	11
SD	2.62	2.34
Median	11	10
Range	8-17	8-17

Table - 9: Distribution of phase II recovery by groups.

Phase II recovery profile	Group P	Group S	P-VALUE
No. of cases	20	20	
Mean	105.5	97.5	
SD	11.11	12.06	
Median	105	97.5	
Range	85-110	80-130	**0.10**

Table - 10: Distribution of cases by post-operative nausea/ vomiting and group.

Postoperative nausea/ vomiting	Group P (n=20)		Group S (n=20)		p-value
	No.	%	No.	%	
Nil	14	70.0	9	45.0	
Yes	6	30.0	11	55.0	**0.20**

Table - 11: Distribution of cases by post-operative pain and group.

Post-operative pain	Group P (n=20)		Group S (n=20)		p-value
	No.	%	No.	%	
Nil	16	80.0	14	70.0	
Yes	4	20.0	6	30.0	**0.72**

It was noted that the distribution of the number of cases by MPC and two groups was not statistically significant with more proportion of Grade I cases in among Group S than Group P (**Table – 3**).

It was noted that the distribution of a number of cases by MPC and two groups was not statistically significant with more proportion of Grade I cases in among Group S than Group P (**Table – 4**).

It was noted that the actual mean MAP values were generally lesser in Group P than Group S at all-time points studied. The difference in the mean values of MAP at induction, post-op and at discharge compared to the reference value at pre-op between the two groups was observed to be statistically not significant (**Table – 5**).

It was noted that the mean time to loss of consciousness is less in Group P than Group S and the difference was statistically significant (**Table – 6**).

It was noted that there were an equal number of cases with the incidence of apnea among both groups and the difference in distribution was statistically not significant (**Table – 7**).

It was noted that the distribution of Phase I recovery profile between Group P and Group S was statistically significant (p=0.001) as per **Table – 8**.

It was noted that the distribution of Phase II recovery profile between Group P and Group S was not statistically significant (p=0.01) as per **Table – 9**.

It was noted that the distribution of postoperative nausea/ vomiting was less in group P, but not statistically significant (**Table – 10**).

It was noted that the distribution of postoperative pain was less in Group P, but not statistically significant (**Table – 11**).

Discussion

Intravenous agents are used commonly for induction of anesthesia followed by inhalational agents for maintenance. A problem with this technique is the transition Phase from induction to maintenance [11]. The rapid redistribution of the intravenous agent could lead to a lightening of anesthesia before an adequate depth is attained with the inhalational agent [12]. This has promoted the rediscovery of 'single agent' anesthesia, which avoids problems associated with a transition Phase. Propofol is a short-acting general anesthetic agent used widely for total intravenous anesthesia because of its favorable recovery profile and low incidence of side effects [13]. Propofol infusions are also becoming increasingly popular for maintenance of anesthesia. However, the use of propofol is associated with pain on injection, cardiovascular and respiratory depression and requires an intravenous drug delivery system [14]. Sevoflurane is a safe and versatile inhalational anesthetic compared with currently available agents. Sevoflurane is useful in adults and children for both induction and maintenance of anesthesia in inpatient and outpatient surgery. Of all currently used anesthetics, the physical, pharmacodynamics, and pharmacokinetic properties of sevoflurane come closest to that of the ideal anesthetic [15]. These characteristics include inherent stability, low flammability, non – pungent odor, lack of irritation to airway, low blood: gas solubility allowing rapid induction of and emergence from anesthesia, minimal end-organ effects, minimal effect on cerebral blood flow, low reactivity with other drugs and a vapor pressure and boiling point that enables delivery using standard vaporization techniques [1]. The aim of this study was to compare the time to loss of consciousness, the incidence of apnoea, induction complication, recovery time and incidence of postoperative nausea, vomiting, and pain when they are used as sole induction and maintenance anesthetic agents in adult tonsillectomies [3]. Despite the low blood: gas solubility of sevoflurane, the inhalation induction of anesthesia was slower than intravenous induction with propofol. Though the incidence of induction complications are more with sevoflurane group, they did not compromise tracheal intubation or hemodynamics except severe bradycardia observed in one patient [5]. The increased incidence of apnea in both groups

is attributable to the enhancement of the ventilator depressant effect of propofol and sevoflurane by the opioid fentanyl. The shorter emergence in sevoflurane group did not translate into a shorter hospital study. And the increased incidence of PONV and pain did not affect the time for home readiness. Though the small sample size in our study precludes drawing statistical conclusions, sevoflurane is found to be a useful alternative for elective procedures of short duration [11, 16].

Conclusion

Induction with sevoflurane is slower and with more complications. The incidence of apnea is equal in both groups. Phase I and II recovery times was comparable between both groups. Sevoflurane anesthesia was associated with high PONV and postoperative pain rate which is statistically not significant. Propofol make it more ideal for induction and maintenance of anesthesia in adult outpatient surgeries.

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