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Research Article

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Comparison of cardiovascular and respiratory changes during induction, maintenance and recovery with sevoflurane and propofol in pediatric day care anesthesia

Nimesh Patel*[1], Maulik M. Patel[2] and Manish V. Patel[3]

[1]*Department of Anesthesia, H. J. Doshi Hospital, Rajkot, Gujarat, India*
[2]*Department of Pharmacology, Mamata Medical College, Khammam, A. P., India*
[3]*Department of Community Medicine, B. J. Medical College, Ahmedabad, Gujarat, India*

ABSTRACT

As the practice of paediatric day care surgery advances, the search continues for anaesthetic agent that provides rapid smooth induction, stable patients' hemodynamics, quick emergence and least side effects. Sevoflurane and propofol both are having cardiovascular and respiratory stable profile in pediatric anaesthesia. to compare the cardiovascular and respiratory changes during induction, maintenance and recovery with propofol and sevoflurane anaesthesia in paediatric day surgery. In this randomized study, a total of fifty children, American Society of Anaesthesiologist (ASA) status I or II, were assigned randomly to intravenous (i.v.) propofol or inhalatory sevoflurane group. N2O was used in both groups. Heart rate, Mean blood pressure (MBP) and peripheral oxygen saturation (SpO_2) were observed and noted during induction, maintenance and recovery. Student t test was used to determine statistical significance of hemodynamic data. No significant differences were detected in age, sex, weight and ASA grading in both the groups performed. The changes in heart rate were comparable. The mean blood pressure was significantly lower in propofol group as compared to sevoflurane group at various intervals (p value<0.05). The changes in mean SpO_2 were comparable except immediately after induction. Sevoflurane showed better intraoperative and postoperative cardiovascular stability than propofol. Respiratory profile is stable and comparable in both the agents.

Key words: Day care Anaesthesia, paediatric, propofol, sevoflurane

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INTRODUCTION

The concept of day care surgery in children is not a new one. In recent years there has been a trend towards performing increasing amount of surgery on children on a day care basis. Children are excellent patients for day care surgery as they are usually healthy and free of systemic diseases. Recent advances in anaesthesia and surgical techniques along with increasing health care costs have resulted in expansion of surgical procedures being performed on day care basis. [1] Advantages of paediatric day care surgeries are reduced behavioral disturbances as child's separation from home is minimum, decreased risk of hospital acquired infections, cost benefit to family and hospital, undisturbed feeding schedule and sleep pattern, high turnover of patients to hospital and shorter waiting lists. [2] Halothane has long been the mainstay of paediatric anaesthesia.[3] However, its role has been challenged recently, and substitution with sevoflurane or propofol has been suggested.[4] Sevoflurane has many features of an ideal inhalational agent; its low blood-gas solubility and non-pungent smell suggest a smooth, uncomplicated and rapid induction of, and emergence from, anaesthesia.[5] Sevoflurane is an attractive option for "volatile Induction maintenance anesthesia" (VIMA) which is proposed to prevent the problems associated with the transition phase between intravenous(i.v.) induction and inhalational maintenance. [6] These properties may make sevoflurane especially suitable for day surgery in children. The choice of i.v. induction agents rests in between thiopental and propofol .The pharmacokinetics of propofol allow rapid induction of anaesthesia, adequate maintenance and rapid recovery of consciousness and reduce post operative morbidity such as nausea, vomiting and respiratory

depression.[7] For, paediatric day care surgery, anesthesiologists usually prefer anesthetic techniques more likely to be associated with rapid induction and rapid emergence which is fulfilled by either with total intravenous anesthesia using propofol or with inhalational anesthesia using sevoflurane.

The aim of this study was to compare the cardiovascular and respiratory changes during induction, maintenance and recovery with Sevoflurane and Propofol in paediatric day care anesthesia.

EXPERIMENTAL SECTION

After obtaining the approval of the Ethics Committee, Fifty patients were enrolled in the study for paediatric day care surgery. They were equally divided into two groups. Patients of Group A were induced and maintained with inhalational anaesthetic agent sevoflurane. Patients of Group B were induced and maintained with i.v. anaesthetic agent propofol.

Children from one month up to 14 years of age with ASA physical status I or II were included. Their parents were capable of understanding their role and give consent for study. They were asked to stay in a nearby distance (30 – 40 kilometers) from the hospital after discharge. Basic preoperative clinical assessments of children were done on OPD (outpatient department) basis with urine examination and Hemoglobin measurement. Further investigations were advised on the basis of clinical examination of patient.

On admission, patients were reassessed and intravenous cannula was inserted and fixed properly. For Group B, patients' large vein was selected.

All the patients were premedicated with Inj. Glycopyrrolate 0.01 mg/kg I.V, Inj. Midazolam 0.05 mg/kg i.v. was given to children > 6 months of age. Induction was started in Group A with either 50 % O_2 + 50% N_2O +3 volume % of sevoflurane increasing concentration stepwise and in Group B with Inj. Propofol 3-4 mg/kg i.v. when expected duration of surgery was less than 20 minutes. Patient were maintained with either 50% O2 + 50% N_2O + Sevoflurane by face mask or 50% O2 + 50% N_2O by mask + Propofol infusion 8 mg/kg/hr by infusion pump. When expected duration of surgery was more than 20 minutes, all patients were given Inj. Atracurium 0.5 mg/kg i.v. after induction and intubated. Inj. Atracurium was given according to the requirement of surgery and reversed with Inj. Glycopyrrolate and Inj. Neostigmine at the end of surgery.

All patients underwent routine monitoring, electrocardiogram, automatic blood pressure and finger or ear pulse oximetery recording. Vital parameters i.e. heart rate, mean blood pressure, SpO_2 were observed and noted at various intervals during induction, maintenance and recovery.

All patients were given appropriate maintenance fluid in form of Inj. Isolyte P and was continued in the post operative period until they start taking oral fluids. For pain management, Inj. Paracetamol 10 mg/kg i.v. was given to each patient after induction of anaesthesia. Patients were shifted to post anaesthesia care unit after recovery from general anaesthesia and were observed for vital signs, airway and SpO_2. They were shifted to the ward when they become fully awake.

Data are presented as mean with standard deviation (SD) .Statistical analysis was performed by using SPSS 15. Student *t* test was used for comparison of hemodynamic data. Value of $P<0.05$ was considered as significant in this study.

RESULTS

Demographic Data and ASA grading of patients is shown in [Table 1].There was no significant different in the mean age, mean weight and sex distribution in two groups. More number of patients of ASA grade I in both groups. There was no significant difference in mean heart rate (Beats / minute) at various intervals in both groups [Table 2]. MBP of propofol group were significantly lower than sevoflurane group at various intervals. At the end of anaesthesia, MBP difference is highly significant ($P=0.002$) [Table 3]. There was no significant difference in mean SpO_2 (%) at various intervals in both groups, except immediately after induction ($P=0.015$). [Table 4]

Table 1.Demographic and ASA characteristic of patients

Variable	Group A (n=25)	Group B (n=25)
Mean Age (Years)	3.30	3.72
Number of Male (% of patients)	16 (64%)	18 (72%)
Number of Female (% of patients)	9 (36%)	7 (28%)
Mean Weight (kg.)	13.6	14.8
ASA I	21 (84%)	20 (80%)
ASA II	4 (16%)	5 (20%)

Table 2. Mean heart rate (beats/minute) at various intervals (Values are mean ± SD)

Intervals	Group A(n=25)	Group B(n=25)	*P* value
Before Induction	101.24 ± 12.45	101.2 ± 11.12	0.9905
Immediately after Induction	92.44 ± 13.7	90.8 ± 12.2	0.6569
5 min	89.4 ± 10.42	89 ± 13	0.9049
10 min	90.48 ± 11.7	88.4 ± 13.4	0.5615
15 min	88.36 ± 10.16	90.5 ± 10	0.4566
30 min	92.17 ± 6.94	94.1 ± 12.3	0.4977
At end of anaesthesia	100.8 ± 7.61	97.9 ± 12	0.3126
Immediate Post-operative	95.6 ± 5.87	95.4 ± 11.5	0.9386
Post-operative in Recovery room	94.9 ± 5.63	95.1 ± 10.6	0.9339

**P<0.05*

Table 3. MBP (mmHg) at various intervals (Values are mean ± SD)

Intervals	Group A(n=25)	Group B(n=25)	*P* value
Before Induction	69.31 ± 8.44	67 ± 9.53	0.3688
Immediately after Induction	66 ± 8.35	62.4 ± 8.66	0.1411
5 min	67 ± 7.44	63 ± 8.06	0.0745
10 min	69 ± 7.69	63.79 ± 8.31	**0.0258***
15 min	70 ± 7.25	65.42 ± 8.2	**0.0417***
30 min	70 ± 9.48	67.81 ± 9.4	0.4162
At end of anaesthesia	72.64 ± 7.98	66 ± 6.77	**0.0026***
Immediate post-operative	71 ± 8.15	67 ± 6.34	0.0587
Post-operative in Recovery room	72.4 ± 7.57	68 ± 5.7	**0.0245***

**P<0.05*

Table 4. Mean SpO_2 (%) at various intervals (Values are mean ± SD)

Intervals	Group A (n=25)	Group B (n=25)	*P* value
Before Induction	99.32 ± 0.75	99.16 ± 0.62	0.4151
Immediately after Induction	99.28 ± 0.74	99.88 ± 0.93	0.0150*
5 min	99.2 ± 0.82	99.48 ± 0.59	0.1722
10 min	99.36 ± 0.76	99.52 ± 0.51	0.3864
15 min	99.57 ± 0.51	99.47 ± 0.50	0.4873
30 min	99.67 ± 0.82	99.44 ± 0.53	0.2447
At end of anaesthesia	99.64 ± 0.49	99.4 ± 0.58	0.1206
Immediate post-operative	99.28 ± 0.68	99.,32 ± 0.63	0.8301
Post-operative in Recovery room	98.64 ± 0.81	98.72 ± 0.79	0.7252

**P<0.05*

DISCUSSION

Patient preferences and economic pressures are driving an increase in day-case elective surgery. [8] From an economic perspective, the comparative costs of surgical care in the day case setting are lower than in an inpatient setting. [9] From the patients' perspective, the benefit of day surgery is the avoidance of an overnight hospital admission with minimal lifestyle disruption. These advantages may be particularly important in the paediatric population and the number of paediatric day-case surgical procedures is increasing. [10]

General anaesthesia is the commonest technique used for paediatric day care surgery, as co-operation of children with regional anaesthesia is poor. Rapid and smooth induction & emergence from anaesthesia and post-operative recovery of cognitive function as well as hemodynamic stability are important requirements of modern day care anaesthesia. Both Propofol and Sevoflurane fulfill these criteria. [11, 12]

This study was conducted with the objective to compare the hemodynamic and respiratory changes during induction, maintenance and recovery of general anesthesia with sevoflurane and propofol in pediatric patients undergoing day

care surgeries. Fifty patients of ASA status I or II aged one month to 14 years were studied as per the protocol mentioned before. As per table-1 there was no significant difference in the mean age, weight and sex distribution in two groups.

Heart rate, MBP and SpO_2 were observed before and after induction, at various intervals during maintenance and recovery from anaesthesia.

Heart rate reduced immediately after induction but required no pharmacological treatment in both group of patients. Comparison between two groups of patients, there is no statistically significant changes in heart rate. Ismai Kati et al. and found that no significant difference in terms of Heart rate in both groups.[13] But Some Previous studies have detected significantly decrease in heart rate after induction in Propofol group compared to Sevoflurane group. That effect is due to action of propofol on cardiac parasympathetic tone. [14]

After induction, MBP decreased in both groups. But decreased MBP was significant ($p<0.05$) with Propofol induction. Previous studies have detected significantly decrease in mean arterial pressure and heart rate after induction in Propofol group compared to Sevoflurane group. [13,14,15,16]

During maintenance and recovery, mean MAP was maintained within 10% of baseline value in both groups and required no pharmacological treatment. Similar finding was found in study by Ismai Kati et al. [13]

SpO_2 remained stable throughout surgery between 97 to 100% in both the groups. Immediately after induction statistically significant reduction of SpO_2 in patients of sevoflurane group as compared to halothane group but overall it was above 99%.similar finding noted in study done in Istanbul.[17]

In the current study, the use of sevoflurane resulted in greater hemodynamic stability while propofol caused reduction in blood pressure. There was no significant difference in the SpO_2 in two groups. Many studies stated that Sevoflurane is an acceptable alternative to Propofol for induction and maintenance of out-patient anaesthesia. [16, 19]

CONCLUSION

Sevoflurane showed better intra-operative and post-operative cardiovascular stability than propofol. Respiratory profile is stable and comparable in both the groups.

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