ORIGINAL RESEARCH PAPER

Medical Science

A CLINICAL COMPARATIVE STUDY OF INHALATIONAL SEVOFLURANE AND INTRAVENOUS PROPOFOL FOR LARYNGEAL MASK AIRWAY ANAESTHESIA IN PAEDIATRIC PATIENTS

KEY WORDS: Sevoflurane; laryngeal mask airway; propofol; paediatric)

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ABSTRACT

Abstract- Objective: To compare effectiveness of inhalational sevoflurane and intravenous (IV) propofol anaesthesia with the laryngeal mask airway (LMA) in children undergoing day care surgery.

Method: 60 premedicated children between 1-12 years of age of ASA grade I or II posted for day care procedures were included in the study and received either induction with sevoflurane 7% by face mask and maintained with a 50% oxygen and 50% nitrous oxide mixture followed by 1.6% sevoflurane or induction with 3 mg/kg propofol IV followed by infusion of 170µg/kg/min with LMA. Demographic data, induction time, number of attempts, LMA insertion, removal and recovery times, haemodynamic parameters, complications, Modified Aldrete score were recorded.

Results: Demographic data and induction time were comparable for both the groups. LMA insertion was successful at the first attempt in 83.3% with sevoflurane and 96.7% with propofol. LMA insertion, removal and recovery times were significantly shorter in the sevoflurane group (106.2±17.68 seconds, 2.41±0.39 minutes, 5.54±0.66 minutes respectively) than in the propofol group (122±13.32seconds, 5.24±0.23minutes, 11.83±2.63 minutes respectively) (P<0.05). Modified Aldrete score were significantly higher in Sevoflurane group (8.50) than in Propofol (5.96) at 5 minutes (P<0.05) and similar at 10 and 15 minutes. Haemodynamics were similar in both groups and perioperative complications were comparable.

Conclusions: Sevoflurane provided shorter LMA insertion, removal and recovery times than IV propofol in children undergoing day care surgeries with similar perioperative complications.

INTRODUCTION

Laryngeal mask airway (LMA) has gained widespread acceptance in paediatric anaesthesia as it bridges the gap between endotracheal tube and facemask, thereby ensuring effective (spontaneous or controlled) ventilation (Bortone L et al.2006[1]). It is a simple, well tolerated, safe, reusable, cost effective method for airway management in both neonatal and paediatric patients (Lerman J.et al.1996,[2] Fredman B. et al.1995[3]). It confers the advantage of reduced stress response and airway resistance (Penant JH et al.1993,[4]).

Satisfactory insertion of LMA after induction of anaesthesia [commencement of giving drugs either intravenous (IV) or inhalational to loss of eyelash reflex] requires sufficient depth of anaesthesia. To find the ideal induction agent for LMA insertion various studies have been carried out (Lopez Gil M et al.1999,[5] Mary EM et al.1999[6]). Sevoflurane is a lately introduced halogenated volatile anaesthetic agent. Amongst the currently available anaesthetics it is an attractive substitute that has replaced halothane for inhaled anaesthetic induction in paediatric patients especially those who are needle phobic (Ibraheem NM et al.2003[7]). Its low blood gas solubility, nonpungent odor and lack of irritation to the airway passages makes it a preferred anaesthetic agent for rapid induction and recovery from anaesthesia (Paris ST et al.1997[8], Sarner JB et al.1995[9]). Propofol is the currently used IV agent of choice for induction and maintenance in outpatient, short surgical procedures because of its favorable recovery profile and low incidence of side effects like respiratory depression (Tesniere A et al.2003,[10] Thwaites A et al.1997[11]). It has several advantages such as less frequent incidence of postoperative nausea and vomiting, agitation and less operating room pollution when compared to sevoflurane (Joo H.S et al.2000[12]). This study was being conducted to compare Sevoflurane and Propofol for insertion of laryngeal mask airway in children. The time taken for induction, Recovery time, time to LMA insertion, hemodynamic parameters, intraoperative and postoperative complications are compared.

OBJECTIVE

This randomized prospective study was designed to compare the effectiveness of propofol and sevoflurane anaesthesia with LMA for children undergoing day care surgery.

METHODS

Sample size calculation: Based on LMA insertion, removal and recovery times power analysis was performed in order to compare the effect of sevoflurane with propofol. This analysis was based on two samples with 80% power and statistical significance of 0.05. Thus the power analysis indicated that the minimum number of patients in each group should be 30.

60 children between 1-12 years of age of ASA grade I or II posted for any day care procedures were included in the study in Silchar Medical College conducted between 1st June 2017 to 31st May 2018. Hospital ethics committee approval was obtained before commencing this prospective randomized clinical trial. Informed and written consent was obtained from parents. Exclusion criteria included ASA III – IV, patients with oropharyngeal pathology, at risk of aspiration or hypersensitivity to halogenated anaesthetic agents or propofol and laparoscopic procedures.

The children fasted from solids for 6 hours and from clear liquids for 2 hours before anaesthesia. Preoperative anxiety was reduced with oral midazolam 0.5mg/kg one hour before induction. Standard monitoring like electrocardiogram, pulse oximeter, capnography and non-invasive blood pressure were applied and baseline vital parameters were recorded. Intravenous infusion of crystalloid started. Intravenous premedication in the form of injection glycopyrrolate 4µ/kg and injection Fentanyl 2µg/kg 10 minutes prior to surgery were given. Size of LMA selected according to manufacturer's guideline. Adequate preoxygenation with 100% oxygen for 3 minutes was done. In group S induction with sevoflurane 7% with 50% O2 and 50% N2O was done. The sevoflurane concentration was increased to 2% as soon as movements occurred. In group P, patients were induced with propofol 3mg/kg with 50% O2 and 50% NO2. Injection Xylocard (2%) 10 mg mixed with bolus dose of propofol to prevent pain produced by injection of propofol. During injection once the child moved additional boluses of 1 mg/kg of propofol were given. The induction time (time taken for induction) was noted in all patients from the time of start of drug administration (either sevoflurane or propofol) to the onset of loss of consciousness (loss of eye lash reflex). After achieving proper relaxation of jaw, insertion of appropriate size of LMA was attempted. Number of attempts were noted. LMA insertion time is from start of induction to successful placement of LMA. Coughing / gagging, laryngospasm/ any airway obstruction and patient movements were noted in all patients. Successful placement of LMA was judged by capnography and chest wall movement. Diclofenac suppositories

were inserted in all patients of both groups. In patients where position of LMA were found to be unsatisfactory were removed and immediately intubated with proper size endotracheal tubes. Such incidences were regarded as failure. In both groups, anaesthesia was maintained with 50% O2 + 50% N2O along with 1.6% sevoflurane in Group S and infusion of propofol 170µg/kg/minute using infusion pump in group P with spontaneous breathing. Injection fentanyl 1µg/kg was repeated if surgery lasted for > 60 minute. Heart rate, blood pressure, ETCO2 and SpO2 were monitored throughout surgical procedure. These vitals were recorded at following stages: Baseline, after giving premedication, at induction, after insertion of LMA, then at 2, 5, 10, 15 minutes and thereafter at every 15 minutes till complete recovery from anaesthesia. The maintenance dose of sevoflurane or propofol was continued until the completion of surgery. Surgical time (first incision to final dressing placement) and anaesthesia time (start of anaesthesia until LMA removal) were noted. At the end of procedure, the infusion of propofol or sevoflurane was discontinued and 100% oxygen was given. Observed for recovery and recovery time noted. Recovery time defined as interval from completion of surgery to achievement of Modified alderte score of 9. LMA was removed in the operating room when the patient was fully awake (children: responding to verbal commands; young children: crying, spontaneous eye opening, purposeful movement). LMA was deflated and removed gently and surface checked for any presence of blood or foreign material. LMA removal time defined as interval from discontinuing anaesthesia to LMA removal. Patients were observed for any post-operative complications like sore throat, nausea, vomiting, agitation etc. Patients were transferred to recovery room when they had a patent airway acceptable respiration pattern, normal oxygen saturation with no need for mandibular support. The child was observed and an oxygen mask was applied and the recovery time were recorded. Modified Aldrete score (given below) recorded at 5, 10, 15minute interval.

Statistical Analysis:

Statistical Package of Social Sciences (SPSS) version 16.0. was used to perform the statistical analysis. Continuous data are described as mean± SD (standard deviation) and categorical variables are given as number (or percentage). Continuous variables were compared using unpaired two sample t-test and Categorical variables were compared using Chi-square test and Fisher exact test. Both the test had a confidence interval of 95%. P values calculated and P< 0.05 was considered significant.

RESULTS:

Table 1shows the demographic data, duration of surgery and anaesthesia, type of surgery and induction time performed were similar for the two treatment groups

	Group S	Group P	P value
Age	7.03±2.90	7.15±2.93	0.87
Gender	21:9	24:6	0.37
Weight	15.58±4.64	14.95±4.48	0.59
Surgery time	50.50±1.30	50.53±1.31	0.98
Anesthesia time	53.43±5.71	55.20±5.09	0.21
Induction time	41.36±3.88	41.93±3.54	0.55
TYPE OF SURGERY			
Herniotomy	7	8	0.76
Circumcision	2	2	1
Hypospadias repair	2	0	0.15
Excision biopsy	4	3	0.68
Incision and drainage	2	2	1
Cataract Surgery	3	4	0.68
Implant removal	10	11	0.78

Table 1 showing the demographic variables

LMA insertion was successful in all enrolled children and adequate ventilation was achieved in all. It was successful at the first attempt in 25/30 (83.33%) with sevoflurane and 29/30 (96.66%) with propofol. The LMA insertion, removal and recovery times were significantly shorter in the sevoflurane group (102.6 ± 17.68seconds), (2.41 ± 0.39minutes), (5.54 ± 0.66 minutes) respectively than in the propofol (122 ± 13.32 seconds), (5.24 ± 0.43minutes), (11.83 ± 2.63) minutes respectively) (P < 0.05) which was statistically significant. (figure 1,2,3 respectively) During maintenance, four patients in group P moved, which as opposed to no patients in group S which was statistically significant. Postoperative problems did not differ between groups. Perioperative systolic arterial blood pressure (SAP) and heart rate (HR) were similar for each group during induction and maintenance of anaesthesia except that the fall in systolic blood pressure was more at 2minute post LMA insertion in propofol group which is statistically insignificant.

Figure1 showing the comparison of insertion time

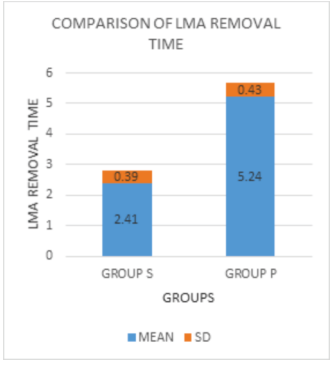

Figure2 showing the comparison of LMA Insertion Time

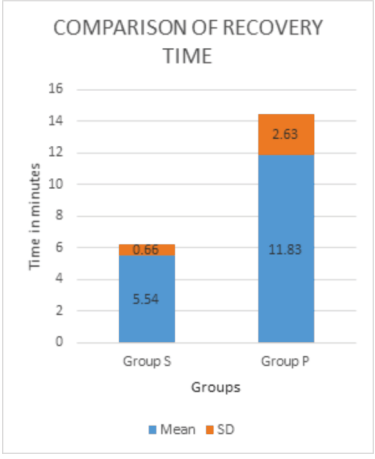

Figure3 showing the comparison of recovery time

Group	Apnea	Coughing	Patient movement
Group S	1	2	0
GroupP	4	0	4
P value	0.16	0.15	0.03

Table 2 showing comparison of intraoperative compl ications between 2 groups

Group	Blood on LMA	Sore throat	laryngospasm	Nausea and vomiting
GroupS	1	2	1	3
GroupP	2	3	0	0
P value	0.59	0.64	0.31	0.07

Table 3 showing comparison of postoperative compl ications between two groups

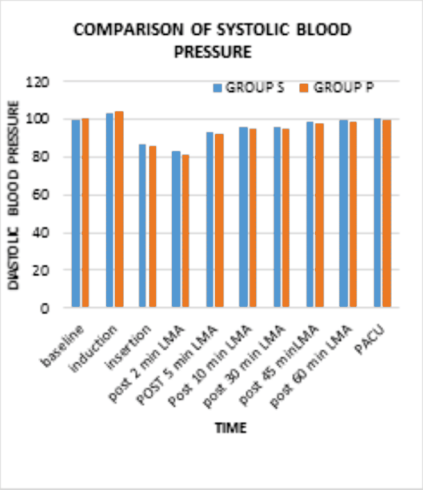

Figure 4 showing comparison of systolic blood pressure

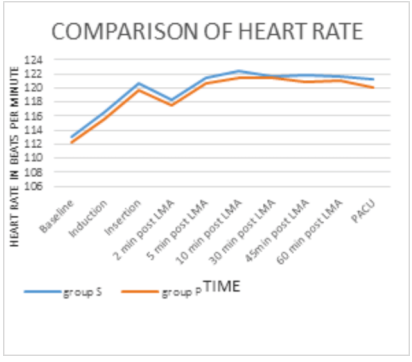

Figure 6 showing comparison of heart rate

Aldrete score was higher in group S at 5 minutes which was statistically significant but comparable at 10 and 15 minutes.

DISCUSSION

Sevoflurane and propofol are commonly used agents for induction and maintenance of general anaesthesia in children with LMA to reduce morbidity with endotracheal tube.

Higher induction dose of propofol in children, which is possibly explained by a large central volume of distribution of the drug and a greater cardiac output per kilogram body weight which should result in a lower

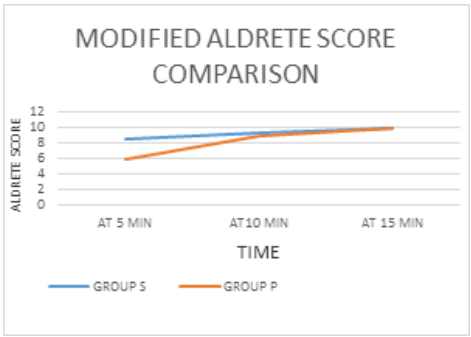

Figure5 showing comparison modified aldrete score between 2 groups

peak concentration of propofol in the blood perfusing the brain after bolus injection (Martlew R.A.et al.1996[13]). Thus we used a larger dose of 3mg/kg of propofol for induction and 170 g/kg/min propofol infusion for maintenance (Iclal Ozdemir Kol. 2008[14], Usher A.G et al.2005[15]). Dose regimen of sevoflurane was in agreement with previous studies (Keller C et al.1998[16]). In the present study, induction was equally fast in both study groups, which is similar to other studies (Joo H.S et al.2000[12]) as sevoflurane has low blood-gas partition coefficient. The average number of attempts for insertion in our study was 1.16 for sevoflurane group and 1.03 for propofol group and the difference was not statistically significant (p>0.05). In our study, mean LMA insertion, removal and recovery times were significantly shorter with group S than group P, a finding that is consistent with two previous studies (Lopez Gil M et al. 1999,[5] Iclal Ozdemir Kol. 2008[14]). In group S Aldrete score was higher at 5 minutes. Slower recovery from anaesthesia with propofol as compared to sevoflurane was due to rapid wash in and out of sevoflurane in children owing to their low blood gas solubility, greater cardiac output directed to the vessel rich group and greater alveolar ventilation while redistribution of propofol is responsible for its delayed recovery. Haemodynamic variables were comparable in both groups in the perioperative phase, as both decreases systemic vascular resistance (Lopez Gil M et al. 1999,[5] Jun L et al.2008[17]). In sevoflurane group two patient had cough during induction which might be attributed to inadequate depth of anaesthesia or lack of effect of premedication which was similar to previous studies (Lerman j et al.1995[2]) where they observed coughing in 1.5% patients during induction in sevoflurane group. Laryngospasm occurred more frequently during sevoflurane anesthesia (Oberer C et al. 2005[18]). After insertion of LMA, during initial phase of maintenance 13.33% patients moved in propofol group was in agreement with the study of I.O.KOL et al.2008[14]. In our study incidences of apnea were higher during induction in propofol group (13.33%) than sevoflurane group (3.33%) but statistically insignificant. It produces dose dependent depression of ventilation, with apnea occurring in 20-35% of patients after induction of anaesthesia with propofol (Bouillon Tet al.2004 [19]).

CONCLUSION

1) Sevoflurane at the doses used in this study provided shorter LMA insertion and removal times than intravenous propofol.
2) Intra and post-operative complications are comparable in both the groups.
3) Haemodynamic effects were comparable in both the groups.
4) Emergence is more rapid in sevoflurane group.

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