Saudi Journal of Medical and Pharmaceutical Sciences
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

ISSN 2413-4929 (Print)
ISSN 2413-4910 (Online)

Prospective Study of Sevoflurane with Laryngeal Mask Airway in Children

Dr. Namrata Jain[1], Dr. Anju Gautam[2*]
[1]Consultant Anaesthesiology, Cancer Hospital & Research Centre (CHRI), Cancer Hills Road, Amkhoh, Gwalior, Madhya Pradesh, India
[2]Assistant Professor, Gajara Raja Medical College (GRMC), Lashkar, Gwalior, Madhya Pradesh, India

Original Research Article

***Corresponding author**
Dr. Anju Gautam

Article History
Received: 09.12.2018
Accepted: 18.12.2018
Published: 30.12.2018

DOI:
10.21276/sjmps.2018.4.12.18

Abstract: The aim of the study was to study effectiveness of inhalation sevoflurane with the laryngeal mask airway (LMA) in children undergoing surgeries below umbilicus. Thirty premedicated children 3-12 years old with the American Society of Anaesthesiologists physical status of I to II were enrolled and received induction with sevoflurane 7% by face mask and maintained with 50% oxygen and 50% nitrous oxide mixture followed by 1.7% sevoflurane with LMA. Demographic data, induction time, number of attempts, LMA insertion, removal and recovery times, haemodynamic parameters, complications, Aldrete score and child's behaviour score were recorded. LMA insertion was successful at the first attempt in 93% with sevoflurane. LMA insertion, removal and recovery times were (1.26±0.36, 2.76±0.51, 5.16±1.6 minutes respectively). Perioperative minor complications were there. Recovery milestones including Aldrete score in the group was (9.03) t 5 minutes and comparable at 15 and 30 minutes. There was a greater incidence of excitatory phenomena with sevoflurane. Haemodynamics were studied. Sevoflurane provided short LMA insertion, removal and recovery times in children undergoing minor surgeries below umbilicus with little perioperative complications. Agitation was seen with sevoflurane.

Keywords: Sevoflurane; laryngeal mask airway; paediatric.

INTRODUCTION

In paediatric anaesthesia laryngeal mask airway (LMA) has gained widespread acceptance as it provides an effective bridge between face mask and endotracheal tube, thereby providing effective (spontaneous or controlled) ventilation [1].

It is a simple, well tolerated, safe, reusable, cost effective method for airway management in both neonatal and paediatric patients [2, 3]. It minimizes stress response and airway resistance [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. Various studies have been carried out to find the ideal induction agent for LMA insertion [5, 6]. Inhalation induction remains a widely used technique in paediatric anaesthesia [7]. Sevoflurane is a recently introduced halogenated volatile anaesthetic agent. It is an attractive alternative to the currently available anaesthetics and has replaced halothane for inhaled anaesthetic induction in needle phobic paediatric patients [8]. Its low blood gas solubility, non pungent odour and lack of irritation to the airway passages makes it a very useful anaesthetic for rapid induction and recovery from anaesthesia [9, 10]. Ability to induce and maintain anaesthesia with one drug, better conditions for LMA insertion, an ability to induce anaesthesia without IV access, thereby facilitating patient turnover in busy ambulatory settings are other advantages [9, 10]. It has disadvantages such as more frequent incidence of postoperative nausea and vomiting, agitation and increased pollution of the operating room with anaesthetics when compared with IV propofol [11]. We hypothesized sevoflurane would provide better anaesthesia and a shorter recovery time [12, 13].

OBJECTIVES

This prospective study was designed to study the effectiveness of sevoflurane anaesthesia with LMA for children undergoing minor surgeries below umbilicus.

METHODS

Sample Size Calculation

Analysis was performed to evaluate the effect of sevoflurane on the LMA insertion, removal and recovery times. This analysis was based on the sample size (30).Thirty children aged 3-12 years with American Society of Anaesthesiologists (ASA) physical status of class I – II scheduled for minor surgery below the umbilicus participated in this study. Informed written consent was obtained from all parents.

Exclusion criteria included ASA III – IV, patients with oropharyngeal pathology, at risk of aspiration or hypersensitivity to halogenated anaesthetic agents.

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, capnograph and noninvasive blood pressure were applied and baseline vital parameters were recorded. After establishing an IV line, injection glycopyrrolate 4µg/kg and injection fentanyl 2µg/kg IV 10 minutes prior to induction were given. Children had inhalational induction with sevoflurane 7% in nitrous oxide 50% and oxygen 50% on face mask at a total gas flow of 6 litres per minute. The sevoflurane concentration was increased to 1% when movement occurred. The induction time was noted from the start of drug administration to the loss of eyelash reflex. The LMA was inserted when the jaw was relaxed and the eyelash reflex was absent. The insertion and fixation technique, size selection and cuff volume were according to manufacturer's instructions. LMA insertion time (start of induction to successful placement of LMA) was noted. Ease of insertion, coughing, gagging, laryngospasm, airway obstruction and patient movement were noted. Successful placement of LMA, judged by capnography, chest wall movement and number of attempts, were noted. A failed attempt was defined as removal of the device from the mouth. Anaesthesia was maintained with 50% oxygen and 50% nitrous oxide, 6 L/min flow rate and 1.7% sevoflurane and with spontaneous breathing. Injection fentanyl 1µg/kg was repeated if surgery lasted for more than 60 minutes. During LMA insertion episodes of gastric distention, regurgitation, aspiration, bronchospasm and apnoea were noted. Vital parameters were recorded at baseline, at induction, after insertion of LMA, at 2, 5, 10, 15 minutes and then every 15 minutes till complete recovery from anaesthesia. At the end of the procedure, sevoflurane was discontinued and 100% oxygen was given. Total duration of surgery (incision to dressing) and duration of anaesthesia (start of anaesthesia until removal of LMA) were noted. Patients were observed for recovery and recovery time (time from completion of surgery to achievement of Aldrete score of 9) was noted. LMA was removed when the patient was fully awake. LMA removal time (time from discontinuation of anaesthesia to LMA removal) was noted. LMA was checked for presence of blood or foreign material, displacement from pharynx, gastric distention and persistent leak. Fall of oxygen saturation <90% any time during anaesthesia was also documented. Postoperative complications like coughing, laryngospasm, sore throat, nausea and vomiting and excitatory phenomena (agitation) were noted. Patients were transferred to recovery room when they had a patent airway and normal oxygen saturation without need for mandibular support. Hudson oxygen mask was applied. Before start of procedure paracetamol suppository (20-30mg/kg) was inserted for postoperative analgesia. Recovery was assessed with the Aldrete score at 5, 15 and 30 minutes following LMA removal.

Statistical Analysis

Statistical analysis was performed using Statistical Package of Social Sciences (SPSS) version 12. Continuous data are described as mean ± SD (standard deviation) and categorical variables are given as number (%).

RESULTS

Demographic data, duration of surgery and anaesthesia, type of surgery and induction time performed were recorded (Table-1).

Table-1: Demographic data, duration of surgery & anaesthesia, induction time & type of surgery for the treatment group

	Group-S
Age (years)	5.38 ± 2.46
Gender (M : F)	20:10
Weight (kg)	15.43 ±4.12
Total surgery time (minutes)	67± 13.8
Total anaesthesia time (minutes)	72.76 ± 13.53
Induction time (seconds)	45.57
Types of Surgery	
Ureteroscopic lithotripsy (URS)	17
Posterior urethral valve fulguration	04
Herniotomy	01
Percutaneous cystolithotripsy (PCCL)	03
Others	05

LMA insertion was successful in all enrolled children and adequate ventilation was achieved in all. It was successful at the first attempt in 28/30 (93%) with sevoflurane The LMA insertion, removal and recovery times were seen as (1.26±0.36, 2.76±0.51, 5.16±1.6 minutes respectively) (Fig-1).

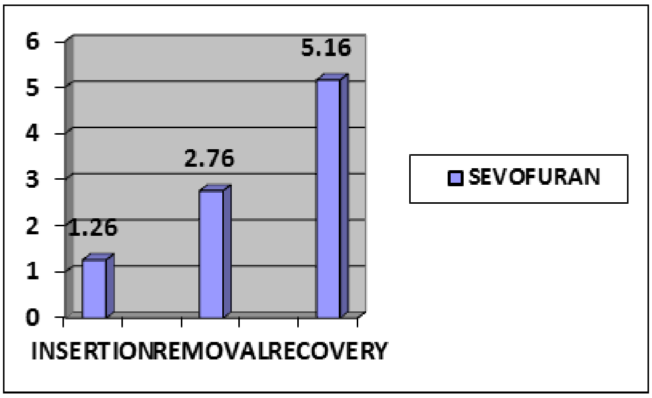

Fig-1: LMA insertion, removal and recovery times in the sevoflurane groups

During LMA insertion no episodes of gastric distention, regurgitation, aspiration or bronchospasm occurred. Recovery milestones, including Aldrete score, were (9.3) at 5 minutes (Table-2). During recovery, 13% children in sevoflurane group were agitated (Table-2).

Tabe-2: Side effects during induction, maintenance & recovery & recovery score

	Group-S (n=30)
Coughing	1 (3.33%)
Laryngospasm	0 (0%)
Apnea	2 (6.66%)
Patients movement	1 (3.33%)
Vomiting	0 (0%)
Maintenance period	
LMA displacement	0 (0%)
Gastric distention	0 (0%)
Persistent leak	0 (0%)
	Recovery Period
Coughing	0 (0%)
Laryngospasm	2 (6.66%)
Blood on LMA	2 (6.66%)
Nausea/Vomiting	2 (6.66%)
Agitation	4 (13.3%)
Desaturation	0 (0%)
Aldrete score	
	Group-S
5 min	9.26 ± 0.52
15 min	9.57 ± 0.72
30 min	10.43 ± 0.82

Peri-operative slight rise in systolic arterial blood pressure (SAP) was seen post induction and fall in SAP was seen 2 minutes post LMA insertion which then remained stable throughout the procedure .Increase in heart rate was seen at induction and LMA insertion which then decreased 2min post insertion and remained stable throughout.

DISCUSSION

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

Children needed higher induction dose of propofol, which may be 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 peak concentration of propofol in the blood perfusing the brain after bolus injection [15], 3mg/kg of propofol for induction and 170 µg/kg/min propofol infusion [14, 16]. For sevoflurane our dose regimen was similar to those used in previous studies [17]. In the present study, induction was fast, which is similar to other studies [11, 18] as sevoflurane has low blood-gas partition coefficient. Overall success rate for LMA insertion was 100% in our group, but the average number of attempts for LMA insertion in our study was 1.10 for group S. This may be because conditions for

LMA insertion were reached earlier with sevoflurane as circuit is primed. In the present study, mean LMA insertion, removal and recovery times were significantly shorter, a finding that is consistent with two previous studies [5, 14]. Aldrete score was higher at 5 minutes in group S. This suggested recovery from anaesthesia was faster with sevoflurane. This may be due to rapid wash in and out of sevoflurane in children as they have greater alveolar ventilation, greater cardiac output directed to the vessel rich group, lower tissue and blood solubility. The transient increase in heart rate during induction and insertion of LMA in this study, although modest in magnitude, is comparable to previous studies [19, 20]. Various studies proved both sevoflurane and propofol to be anaesthetics which maintain mean arterial pressure and heart rate close to pre-induction values [21, 22]. The anaesthetic agent might have major effects on the pattern of potentially harmful defensive airway reflexes. Laryngospasm occurred more frequently during sevoflurane anesthesia, whereas cough and expiration reflexes occurred more often during propofol anaesthesia [23]. In contrast to this study we noted less adverse events during LMA insertion, as sevoflurane depress laryngeal reflexes adequately with the doses we used. Coughing during induction in group may be attributed to inadequate depth of anaesthesia. In our study incidence of apnoea in group S (6.7%) but this was statistically insignificant. None of the patients had hypoxaemia during induction because manual ventilation with 100%.oxygen before LMA insertion was done in all the patients. In agreement to other studies we noted lesser incidence of nausea and vomiting with two patient had vomiting [11, 20]. This may be a function of the initial high concentration of sevoflurane or it may be caused by air and gases, which may be swallowed into the stomach during induction. Four patients developed agitation in group S which is statistically significant. Agitation following sevoflurane anaesthesia has an incidence of 10-40% being highest in preschool children, which may be related to earlier perception of pain and preoperative anxiety [24, 25]. Keeping this trend our figure for agitation is 13.3%. The aetiology of agitation is currently unknown. Recent hypotheses emphasizing rapid emergence associated with new anaesthetic agents such as sevoflurane and desflurrane may create a dissociative state i.e. children awaken with altered cognitive perception or involvement of the serotoninergic system. Agitation can be prevented by pain prevention, with the drugs like propofol, ketamine, and α_2-AR agonists [26].

It is possible that the incidence of agitation may be reduced by progressive weaning rather than abrupt cessation at the end of surgery and using drugs preoperatively to reduce anxiety. Inadequate analgesia appears to be an unlikely cause of agitation in our study as pain was adequately taken care of with perioperative analgesia.

CONCLUSIONS

- Sevoflurane at the doses used in this study provided shorter LMA insertion and removal times in children undergoing surgeries below the umbilicus.
- Faster recovery was seen with sevoflurane but agitation was more common with use of this agent.
- Sevoflurane appears to be a useful alternative to propofol for induction and maintenance of general anaesthesia in children with LMA.

REFERENCES

1. Bortone, L., Ingelmo, P. M., Ninno, G. D., Tosi, M., Caffini, L., Trenchi, J., ... & Martorana, F. (2006). Randomized controlled trial comparing the laryngeal tube and the laryngeal mask in pediatric patients. *Pediatric Anesthesia*, *16*(3), 251-257.
2. Lerman, J. (1995). Sevoflurane in paediatric anaesthesia. *Anesthesia & Analgesia*, 81(*Suppl. 6*):S4-S10.
3. Fredman, B., Nathanson, M. H., Smith, I., Wang, J., Klein, K., & White, P. (1995). Sevoflurane for outpatient anesthesia: a comparison with propofol. *Anesthesia & Analgesia*, *81*(4), 823-828.
4. Pennant, J. H., & White, P. F. (1993). The laryngeal mask airway. Its uses in anesthesiology. *Anesthesiology*, *79*(1), 144-163.
5. Lopez Gil, M., Brimacombe, J., & Clar, B. (1999). Sevoflurane versus propofol for induction and maintenance of anaesthesia with the laryngeal mask airway in children. *Pediatric Anesthesia*, *9*(6), 485-490.
6. Molloy, M. E., Buggy, D. J., & Scanlon, P. (1999). Propofol or sevoflurane for laryngeal mask airway insertion. *Canadian journal of anaesthesia*, *46*(4), 322.
7. Lerman, J., & JÖhr, M. (2009). Inhalational anesthesia vs total intravenous anesthesia (TIVA) for pediatric anesthesia. *Pediatric Anesthesia*, *19*(5), 521-534.
8. Ibraheem, N. M., Morabaa, H. A. I. E., Hasan, L., Hofny, K., & Ismael, E. (2003). Sevoflurane Versus Halothane For Induction And Maintenance Of Anaesthesia In Children While Breathing Spontaneously Via A Laryngeal Mask Airway (LMA).
9. Paris, S. T., Cafferkey, M., Tarling, M., Hancock, P., Yate, P. M., & Flynn, P. J. (1997). Comparison of sevoflurane and halothane for outpatient dental anaesthesia in children. *British journal of anaesthesia*, *79*(3), 280-284.
10. Sarner, J. B., Levine, M., Davis, P. J., Lerman, J., Cook, R. D., & Motoyama, E. K. (1995). Clinical characteristics of sevoflurane in children A comparison with halothane. *The Journal of the American Society of Anesthesiologists*, *82*(1), 38-46.

11. Joo, H. S., & Perks, W. J. (2000). Sevoflurane versus propofol for anesthetic induction: a meta-analysis. *Anesthesia & Analgesia*, *91*(1), 213-219.
12. Tesniere, A., & Servin, F. (2003). Intravenous techniques in ambulatory anesthesia. *Anesthesiology Clinics of North America*, *21*(2), 273-288.
13. Thwaites, A., Edmends, S., & Smith, I. (1997). Inhalation induction with sevoflurane: a double-blind comparison with propofol. *British Journal of anaesthesia*, *78*(4), 356-361.
14. Kol, I. O., Egilmez, H., Kaygusuz, K., Gursoy, S., & Mimaroglu, C. (2008). Open-label, prospective, randomized comparison of propofol and sevoflurane for laryngeal mask anesthesia for magnetic resonance imaging in pediatric patients. *Clinical therapeutics*, *30*(1), 175-181.
15. Martlew, R. A., Meakin, G., Wadsworth, R., Sharples, A., & Baker, R. D. (1996). Dose of propofol for laryngeal mask airway insertion in children: effect of premedication with midazolam. *British journal of anaesthesia*, *76*(2), 308-309.
16. Usher, A. G., Kearney, R. A., & Tsui, B. C. (2005). Propofol total intravenous anesthesia for MRI in children. *Pediatric Anesthesia*, *15*(1), 23-28.
17. Keller, C., Sparr, H. J., & Brimacombe, J. R. (1998). Positive pressure ventilation with the laryngeal mask airway in non-paralysed patients: comparison of sevoflurane and propofol maintenance techniques. *British journal of anaesthesia*, *80*(3), 332-336.
18. Ti, L. K., Chow, M. Y., & Lee, T. L. (1999). Comparison of sevoflurane with propofol for laryngeal mask airway insertion in adults. *Anesthesia & Analgesia*, *88*(4), 908-912.
19. Priya, V., Divatia, J. V., & Dasgupta, D. (2002). A comparison of propofol versus sevoflurane for laryngeal mask airway insertion. *Indian J Anaesth*, *46*(1), 31-4.
20. Jun, L., Pung, G., & Hong, C. (2008). Comparison of LMA insertion conditions with sevoflurane inhalational and propofol TCI anaesthesia. *Anesthesiology*, 109: A777.
21. Wiesner, G., Schwürzer, S., Hörauf, K., & Hobbhahn, J. (1994). Emergence times, hemodynamics and adverse effects of sevoflurane and isoflurane: an open, randomized, comparative phase iii study. *Der Anaesthesist*, *43*(9), 587-593.
22. Marshall, C. A., Jones, R. M., Bajorek, P. K., & Cashman, J. N. (1992). Recovery characteristics using isoflurane or propofol for maintenance of anaesthesia: a double-blind controlled trial. *Anaesthesia*, *47*(6), 461-466.
23. Oberer, C., von Ungern-Sternberg, B. S., Frei, F. J., & Erb, T. O. (2005). Respiratory reflex responses of the larynx differ between sevoflurane and propofol in pediatric patients. *The Journal of the American Society of Anesthesiologists*, *103*(6), 1142-1148.
24. Dalens, B. J., Pinard, A. M., Létourneau, D. R., Albert, N. T., & Truchon, R. J. (2006). Prevention of emergence agitation after sevoflurane anesthesia for pediatric cerebral magnetic resonance imaging by small doses of ketamine or nalbuphine administered just before discontinuing anesthesia. *Anesthesia & Analgesia*, *102*(4), 1056-1061.
25. Kain, Z. N., Caldwell-Andrews, A. A., Maranets, I., McClain, B., Gaal, D., Mayes, L. C., ... & Zhang, H. (2004). Preoperative anxiety and emergence delirium and postoperative maladaptive behaviors. *Anesthesia & Analgesia*, *99*(6), 1648-1654.
26. Dahmani, S., Stany, I., Brasher, C., Lejeune, C., Bruneau, B., Wood, C., ... & Murat, I. (2010). Pharmacological prevention of sevoflurane-and desflurane-related emergence agitation in children: a meta-analysis of published studies. *British journal of anaesthesia*, *104*(2), 216-223.