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A COMPARATIVE STUDY BETWEEN ISOFLURANE AND SEVOFLURANE IN PEDIATRIC ANAESTHESIA WITH LARYNGEAL MASK AIRWAY

Anaesthesiology

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ABSTRACT

Aims and objectives: Our study compared Isoflurane with sevoflurane maintenance anesthesia in terms of respiratory events and the emergence characteristics in children with a laryngeal mask airway.

Methodology: This randomized controlled trial evaluated 40 children undergoing strabismus surgery allocated to Isoflurane or sevoflurane groups. After inducing anesthesia with sevoflurane and thiopental sodium 5 mg kg−1, the anesthetic agent was changed to Isoflurane in the Isoflurane group, whereas sevoflurane was continued in the sevoflurane group.

Results: The overall respiratory events did not differ between the groups. However, the incidence of mild desaturation (90% ≤ SpO2 < 97%) was significantly higher in the Isoflurane group (7%) than in the sevoflurane group (0%) (P = .007). Emergence was significantly faster in the Isoflurane group (6.6±3.9 vs 8.0±2.2 min, P = .003).

KEYWORDS

isoflurane, sevoflurane, laryngeal mask airway

INTRODUCTION

Isoflurane has faster emergence with a comparable incidence of emergence agitation compared with sevoflurane even in children.[1,2] However, its pungency can provoke airway irritation, causing secretions, breath-holding, cough, and laryngospasm.[3,4] Therefore, Isoflurane is contraindicated for inhalation induction in children and infants. The use of Isoflurane is considered safe in terms of airway irritability only with an endotracheal tube and during anesthesia maintenance.[5,6]. Furthermore, the Pediatric Advisory committee of the US Food and Drug Administration recommended that Isoflurane labeling be "revised to clearly state that the use of maintenance of non-intubated pediatric patients be contraindicated." [7].

Nevertheless, there is increasing evidence that Isoflurane has a similar incidence of respiratory events as sevoflurane when both are given via an LMA. A retrospective investigation revealed that Isoflurane did not increase the risk of respiratory events in children with LMA.[8] Also, a meta-analysis by Stevanovic et al[9] concluded that, in adults, there is no difference in adverse upper airway events between anesthesia achieved with Isoflurane via an LMA, sevoflurane, isoflurane, or propofol anesthesia.

METHODS

This study used a double-blind, randomized controlled, parallel group design and was conducted at Gori Devi Institute Of Medical Sciences and Hospital, durgapur. The first participant was enrolled on July 25, 2017. After obtaining written informed consent from the children's parents, the study enrolled 40 pediatric patients from 2 to 6 years of age who underwent general anesthesia for strabismus surgery from March 2019 to June 2019. Anesthesia was induced with 5 mg kg−1 thiopental sodium, atropine 0.01 mg kg−1, and 6 to 8 vol% sevoflurane under 100% O2 mask ventilation, followed by 0.3 mg kg−1 rocuronium to facilitate LMA placement. Anesthesia was maintained with 2 to 3 vol% sevoflurane using an oxygen/air mixture in the S group and 2 to 3 vol% Isoflurane using an oxygen/air mixture in the I group. The minimum alveolar concentration (MAC) during the maintenance period was 1.2 to 1.6 MAC in both groups, as determined by the child's age. Emergence agitation was evaluated at 15 minutes after admission to the PACU using the 4-point agitation scale for emergence delirium, on which emergence delirium is defined by a score of 3 or 4 at any time (1, calm; 2, not calm but could be easily calmed; 3, not easily calmed, moderately agitated, restless; and 4, excited or disoriented).[10] The scale is simple to use and provides a meaningful and clear end point for the dichotomous outcome of emergence agitation.[11]

RESULTS

In total, 40 patients completed the study. The patient characteristics are listed in Table 1. The anesthesia time, defined as the time interval between the initiation of inhalation induction and discontinuation of the inhaled anesthetic agents, was longer in the I group than in the S group with statistical significance (mean difference 1.4 min and 95% confidence interval [CI]: 0.1–3.0 min).

Table 2 provides details of the respiratory adverse events. The incidence of coughing, secretion, breath-holding, and laryngospasm was similar in both groups. No patient developed bronchospasm during emergence. However, the incidence of mild desaturation (90% ≤ SpO2 < 97%) was significantly higher in the I group.

Table 3 shows the emergence characteristics of both groups. The emergence time was significantly shorter in the I group (mean difference 1.4 min and 95% CI: 0.5–2.3 min). There were no group differences in recovery time (mean difference 0.4 min and 95% CI: –2.1 to 1.2 min), the incidence of vomiting, and the incidence of overall respiratory adverse events (relative risk 1.05 and 95% CI: 0.74–1.47).

DISCUSSION

In this study, Isoflurane anesthesia following sevoflurane induction showed slightly faster emergence and a comparable incidence of emergence delirium to that of sevoflurane anesthesia. A meta-analysis of LMA usage in pediatric anesthesia concluded that the incidence of desaturation, laryngospasm, cough, and breath-holding during recovery from anesthesia was lower than with tracheal intubation.[13] Even in pediatric patients with an upper respiratory infection which may increase the airway resistance, the LMA usage considered feasible alternative to the tracheal tube.[14,15]

Degree of airway irritability due to inhalation agents differs between normal and susceptible airways.[16] Known risk factors for perioperative respiratory adverse events include a history of recent URI, age less than 6 years,[1] and airway surgery.[17,18] Perioperative respiratory adverse events during pediatric ambulatory anesthesia are increased in children younger than 3 years regardless of the anesthetic regimen, such as LMA or Isoflurane anesthetics.[19]

Faster emergence does not guarantee fast recovery and hospital discharge. Some authors concluded that faster emergence from anesthesia is associated with a higher incidence of postoperative agitation and even a delay in recovery.[20,21] Nevertheless, in this study, Isoflurane during maintenance anesthesia shortened the emergence time but was similar to sevoflurane with respect to emergence agitation and recovery time.

We found no difference in the incidence of emergence agitation between sevoflurane and Isoflurane. Consistent with our results, a systematic review of risk factors for emergence agitation showed that there is no difference in emergence agitation according to the inhalation agent.[22] However, the incidence of emergence agitation with both agents was very high in this study. Emergence agitation may affect the postoperative course,[23] and a multimodal approach to reducing the emergence agitation is needed.[11]

We should consider many factors when we choose an inhalation agent for anesthesia, including drug effectiveness, patient safety, costs, and environmental impact.[24] The operating room is a major source of perioperative costs and the anesthesiologist can affect the efficiency of the operating room by choosing anesthetic options that are cost-effective, safe, and facilitate rapid emergence.[25] Clinicians must consider the risks and benefits of Isoflurane anesthesia with an LMA in children. Careful patient selection and an optimal anesthetic technique are required.

Table 1: The patient characteristics

	S group(n=20)	I group(n=20)
Female: male	12:08	11:09
Age y	4.0(2.0-5.6)	3.8(2.0-6.9)
Height, cm	104.6±12.2	103.6±14.5
Wight, Kg	17.4±4.4	17.3±5.9
Anesthesia time, min	24.7±5.4	26.2±5.8

Values are expressed as mean(range), mean ± SD, or absolute number of patients. S- sevoflurane group, D- Isoflurane group.

Table 2 :Showing the detailed incidence of respiratory adverse events during emergence.

	S group(n=20)	I group(n=20)
Overall respiratory events n	3	4.562
Breath holding n	1	2.231
Coughing n	3	4.581
Laryngospasm	0	1.254
Desaturation	0	1.568

Table 3: Emergence and recovery characteristics.

	S group(n=20)	I group(n=20)	p
Emergence time , min	8(2.2)	6.6(3.9)	.003
Recovery time, min	33.1(15.6)	33.5(6.1)	.723
Vomiting, n	2	5	.441
Four point agitation score	1	8	7
	2	1	1
	3	8	9
	4	3	3

CONCLUSIONS

In conclusion, Isoflurane maintenance anesthesia in children with an LMA might be a possible alternative to sevoflurane during ambulatory anesthesia with respect to the rapid emergence and similar incidence of overall respiratory adverse events.

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