DISCUSSION

Airway irritation is one of the most important characteristics of the volatile anaesthetic agents, especially when they are used for inhalational induction of anaesthesia. Among the anaesthetic agents used clinically, isoflurane and sevoflurane. [46-50] Isoflurane has been reported to induce cough, bronchospasm and breath-holding.

Several studies have been conducted investigating techniques to overcome the adverse airway events associated with inhalation of isoflurane.

The present study was carried out in Alexandria University Hospitals on elective day-case surgery paediatric patients aged 2 to 8 years, ASA physical status I & II undergoing tonsillectomy operations.

After a computerized random selection, the children were assigned to one of two groups:

Group 1: induction and intubation by Isoflurane and Rocuronium 0.3mg/kg.

Group 2: induction and intubation by Sevoflurane and Rocuronium 0.3mg/kg.

The aim of this work was to compare between Isoflurane and Sevoflurane as regards the ease of induction, incidence of complications and to assess intubation conditions with the use of low dose Rocuronium.

In the present study the results regarding systolic blood pressure after intubation in isoflurane group had values statistically higher than sevoflurane group (129.50±6.86 and 121.0±7.18 mmHg for isoflurane and sevoflurane groups respectively).still After 2 minutes, isoflurane group had values statistically higher than sevoflurane group (121.0±6.41 and 116.0±5.03 beats/min for isoflurane and sevoflurane groups respectively).

Wolf et al studied the hemodynamic effects of two sequential end-tidal anesthetic concentrations on 15 unpremeditated ASA I children (2 to 7.3 yr.) admitted for elective surgical procedures. His entire study was completed prior to intubation and the initiation of the surgical procedure. They found an insignificant increase in heart rate with significant decrease in blood pressure. This result was explained by vasodilatation with a fall in systemic vascular resistance. The difference in our results may be caused by the stress of intubation. [51]

Similar results by **Tanaka et al** who studied Fifty ASA physical status I patients, aged 20-40 yrs., scheduled for elective minor surgery, received one of four volatile anaesthetics: sevoflurane, Isoflurane, halothane, or enflurane. Anaesthesia was induced with thiamylal, followed by inhalation of 0.9 minimum alveolar anaesthetic concentration (MAC) of the anaesthetic in 100% oxygen via mask. The inspired concentration of anaesthetic was increased by 0.9 MAC every 5 min to a maximum of 2.7 MAC. Heart rate (HR) and systolic blood pressure (SBP) were measured before and every minute for 15 min during anesthetic inhalation. Similar results regarding SBP which increased significantly from the baseline during 2.7 MAC isoflurane administration (P = 0.0007). The maximum increase in SBP was 10 +/- 4 mm Hg at 12 min. Plasma norepinephrine concentration in the isoflurane group was significantly higher than that in the sevoflurane group during 2.7

MAC (P = 0.022). [39] Also, **Doi and Ikeda** who studied eleven male volunteers to compare the airway irritation produced by the four anaesthetic agents: halothane, enflurane, isoflurane and sevoflurane at two concentrations, equivalent to one and two MAC. Tidal volume, respiratory frequency and functional residual capacity changes induced by 15 sec inhalation of the anaesthetics were measured using respiratory inductive plethysmograph. They found that isoflurane evoked the greatest subjective and objective airway irritation among the volatile anesthetics investigated, followed by enflurane, halothane, and sevoflurane. [38] Mechanical stimulation or chemical irritation of the airways can increase blood pressure and sympathetic efferent nerve activity [52]. In addition, their previous report showed that isoflurane-induced hypertension and tachycardia were inhibited by nasally applied lidocaine [54]. These findings strongly indicate that isoflurane irritate the airway, which subsequently elicits hyperdynamic circulation.

In the present study the results regarding heart rate: Before intubation: isoflurane group had values statistically higher than sevoflurane group (114.25±6.34 and 104.0±5.76 beats/min) for isoflurane and sevoflurane groups respectively (P=0.001). After intubation: isoflurane group had values statistically higher than sevoflurane group (125.25±5.95 and 120.0±7.25 beats/min) for isoflurane and sevoflurane groups respectively (P=0.017). After 2 minutes, isoflurane group had values statistically higher than sevoflurane group (123.0±5.71 and 119.50±5.10 beats/min) for isoflurane and sevoflurane groups respectively (P=0.048). After 10 minutes: sevoflurane group had values statistically higher than isoflurane group (112.50±5.50 and 105.0±6.07 beats/min) for sevoflurane and isoflurane groups respectively (P=0.001).

Sloan et al found that there was a significant increase in heart rates during induction with both sevoflurane and isoflurane . Heart rates reached their peak 3 min after the start of induction, and the increase in heart rate after isoflurane was significantly greater than that associated with sevoflurane.[54]

In the present study the results regarding coughing severity, there was no cough in 19 (95.0%) and 13 (65%), slight cough were found in 1 (5.0%) and 6 (30.0%) for sevoflurane and isoflurane groups respectively. Moderate coughing was found in a single case (5%). There were statistical significant differences between the two studied groups regarding coughing severity (P=0.043). Coughing incidence being more in the isoflurane group.

These results agree with **Goodwin et al** who studied the effect of breathing 0.1 minimum alveolar concentrations (MAC) of desflurane or isoflurane for three minutes on the incidence of adverse air way events on a subsequent breath of 2 MAC for possible desensitisation of the airway to facilitate breathing higher concentrations subsequently without significant adverse airway events. He found that the reduction from 60% to 52% in coughing with 2 MAC isoflurane after 3 minutes of 0.1MAC isoflurane administration which is not significant. Higher incidence of coughing could be explained by that study included only volunteers who had hyper-reactive airways. [55]

Also, **Sloan et al** found that 19 out of 25 coughed after single breath induction with 5%isoflurane in 50% nitrous oxide. [54] The relatively high incidence of airway complications during single-breath isoflurane induction is in agreement with the findings of **Yurino and Kimura** who studied the vital capacity rapid inhalation induction of anaesthesia (VCRII) technique and the conventional spontaneous inhalation

induction technique, each using 4.5% sevoflurane in nitrous oxide and oxygen. [56] The VSRII group (n = 32) and conventional group (n = 32) were each tested on unpremeditated volunteers. Also, **Philips et al** who performed a randomised, prospective trial in which gaseous induction of anaesthesia to 50 unpremeditated children with either isoflurane or halothane in nitrous oxide and oxygen. [48]

In the present study the results regarding time from induction to loss of consciousness, time ranged between 120-180 and 180-240 sec. with the mean of 139.80±24.55 and 196.50±18.14 sec. for sevoflurane and isoflurane groups respectively. The isoflurane group had a statistically longer duration to loss of consciousness than sevoflurane group. (P=0.001)

Sloan et al found that time from induction to loss of consciousness did not differ significantly between sevoflurane (75±3s) and isoflurane (67±4s) it was explained by the differences in anaesthetic potency, this corresponded to approximately 2.9 X MAC for sevoflurane and 4.3 X MAC for isoflurane. The increased potency of isoflurane effectively countered the effect of its increased blood tissue solubility. [54]

In the present study the results regarding time from induction to successful endotracheal intubation showed that, time ranged between 180-270 and 240-330 sec. with the mean of 223.8±31.50 and 291±25.94 sec. for sevoflurane and isoflurane groups respectively. The isoflurane group had a statistically longer duration to successful endotracheal intubation than sevoflurane group. (P=0.001)

Eikermann et al who studied 120 children aged (2-7 yr.) received 8% sevoflurane in 60% nitrous oxide and Rocuronium at different doses found acceptable intubation conditions with rocuronium 0.3mg/kg 2 minutes after induction similar to the present results. [57]

SUMMARY

Inhalational induction in children undergoing tonsillectomy operations is an everyday practice. Despite the presence of several inhalational agents more economic and safe methods are always sought. Sevoflurane is an inhalational anaesthetic with less respiratory irritation and more rapid emergence in comparison to isoflurane but isoflurane is more economic than sevoflurane. The aim of this work was to compare between isoflurane and sevoflurane as regards:

- The ease of inhalational induction and incidence of complications.
- Intubation conditions with the use of low dose rocuronium.

After approval of Local Ethics Committee and obtaining written informed consents from parents of patients, this study was carried out in Alexandria University Hospitals on elective day-case surgery paediatric patients aged 2 to 8 years, ASA physical status I & II. This study was carried out on elective day-case tonsillectomy operations.

Patients were randomly categorized into two equal groups -20 in each:

Group 1: induction and intubation by isoflurane and rocuronium 0.3mg/kg.

Group 2: induction and intubation by sevoflurane and rocuronium 0.3mg/kg

All patients were pre-medicated with oral midazolam (0.5mg/ kg) 30-60 minutes before the induction.

Anaesthesia was induced using a vaporizer set at 0.5 MAC (isoflurane or sevoflurane) in oxygen 6 l/min and isoflurane concentration was increased gradually to reach 3 MAC. Initially, spontaneous respiration was maintained. After loss of consciousness, an IV cannula was inserted and rocuronium 0.3mg/kg was administered. Rapid manual ventilation at a low pressure was started with isoflurane maintained at 3 MAC 2 minutes after start of induction, direct laryngoscopy and tracheal intubation were attempted with an uncuffed tracheal tube size (ID age/4 +4 mm).

The following data were measured: demographic data, heart rate (beats / minute), systolic arterial blood pressure (mmHg) and arterial oxygen saturation (SpO_2 %).

Sedation was assessed according to Ramsay sedation score. Time from (isoflurane or sevoflurane) induction to loss of consciousness, induction to successful endotracheal intubation, successful endotracheal intubation to return of spontaneous breathing. Airway conditions, ease of intubation and response to intubation were assessed by using a scoring system: Laryngoscopy, vocal cord, coughing, jaw relaxation, limb movement. Incidence of hoarseness of voice, post-extubation croup and post-extubation laryngeal spasm in the immediate postoperative period were assessed

Results of this study revealed the following:

- There were no statistical significant differences between the two studied groups regarding sex and age.

- Regarding heart rate: Before intubation: isoflurane group had values statistically higher than sevoflurane group (114.25±6.34 and 104.0±5.76 beats/min) for isoflurane and sevoflurane groups respectively (P=0.001). After intubation: isoflurane group had values statistically higher than sevoflurane group (125.25±5.95 and 120.0±7.25 beats/min) for isoflurane and sevoflurane groups respectively (P=0.017). After 2 minutes, isoflurane group had values statistically higher than sevoflurane group (123.0±5.71 and 119.50±5.10 beats/min) for isoflurane and sevoflurane groups respectively (P=0.048). After 10 minutes: sevoflurane group had values statistically higher than isoflurane group (112.50±5.50 and 105.0±6.07 beats/min) for sevoflurane and isoflurane groups respectively (P=0.001).
- Regarding systolic blood pressure: after intubation: isoflurane group had values statistically higher than sevoflurane group (129.50±6.86 and 121.0±7.18 mmHg for isoflurane and sevoflurane groups respectively). After 2 minutes, isoflurane group had values statistically higher than sevoflurane group (121.0±6.41 and 116.0±5.03 beats/min for isoflurane and sevoflurane groups respectively).
- Laryngoscopy was found easy in 12 (60.0%) and 14 (70.0%), fair in 7 (35.0%) and 6 (30.0%) and difficult in 1 (5.0%) and 0 (0.0%) for sevoflurane and isoflurane groups respectively with no statistical significant differences. Open vocal cords were found in all cases for sevoflurane and isoflurane groups respectively.
- There was no cough in 19 (95.0%) and 13 (65%), slight cough were found in 1 (5.0%) and 6 (30.0%) for sevoflurane and isoflurane groups respectively. Moderate coughing was found in a single case (5%). (P=0.043). Coughing incidence was more in the isoflurane group.
- Regarding jaw relaxation: complete relaxation was observed in 17 (85.0%) and 19 (95.0%), slight relaxation were found in 3 (15.0%) and 1 (5.0%) for sevoflurane and isoflurane groups respectively. There were no statistical significant differences between the two studied groups regarding jaw relaxation.
- There were no statistical significant differences between the two studied groups regarding limb movement.
- Hoarseness of voice and post-extubation croup were found in 1 (5.0%) for both sevoflurane and isoflurane groups. There were no statistical significant differences between the two studied groups.
- There were no statistical significant differences between the two studied groups regarding sedation score.
- Regarding time from induction to loss of consciousness, time ranged between 120-180 and 180-240 sec. with the mean of 139.80±24.55 and 196.50±18.14 sec. for sevoflurane and isoflurane groups respectively. The isoflurane group had a statistically longer duration to loss of consciousness than sevoflurane group. (P=0.001)
- Time from induction to successful endotracheal intubation was a mean of 223.8±31.50 and 291±25.94 sec. for sevoflurane and isoflurane groups respectively. The isoflurane group had a statistically longer duration to loss of consciousness than sevoflurane group. (P=0.001)
- Time from successful endotracheal intubation to return of spontaneous breathing was mean of 22.40±2.09 and 23.00±2.18 minutes for sevoflurane and isoflurane groups respectively. There were no statistical significant differences between the two studied groups.