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Original Article

Effect of Nebulized Salbutamol Premedication on Perioperative Respiratory Adverse Events in Children with Recent Respiratory Tract Infections

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Abstract

Background: A recent upper respiratory tract infection (URTI) is linked to the development of perioperative respiratory complications.

Aim of Study: The aim of the study was to evaluate the effect of salbutamol premedication on the incidence of perioperative respiratory adverse events (PRAEs) in children with a recent URTI (PRAE).

Patient and Method: A randomized clinical trial study conducted at Children Welfare Teaching Hospital for a period of 6 months. It included 90 children aged ≤16 years underwent surgical operation under general anesthesia with a laryngeal mask airway or a tracheal tube and divided into three groups (had a recent URTI and received pre-operative salbutamol, had a recent URTI, and did not receive pre-operative salbutamol, and healthy children group). The preferred outcome was the difference in the rate of occurrence of PRAE between children having received salbutamol and those have not.

Result: Four healthy children (13.3%) developed PRAEs. Incidence of bronchospasm and severe cough was significantly higher in patients with URTI and did not received pre-operative salbutamol than that in those with URTI and received pre-operative salbutamol.

Conclusion: Pre-operative salbutamol doses 10–30 min before surgery have been demonstrated to reduce and treat PRAEs.

Key words: Salbutamol, Upper respiratory tract infection, Perioperative respiratory adverse events, Premedication, Anesthesia, Iraq

INTRODUCTION

In youngsters, the common cold or upper respiratory tract infections (URTIs) are common. Although URTIs are typically mild and self-limiting, they do inflict a financial cost on society due to increased use of health-care resources and time away from work or school.[1] Although some patients are vulnerable to bacterial complications such as acute sinusitis, acute otitis media, and lower respiratory tract infections (RTI), most URTIs are viral in origin and self-limiting. Sore throat, runny nose, nasal congestion, sneezing, dry cough, slight fever, and a feeling of malaise are all symptoms of URTIs.[2] Airway inflammation is linked to a recent URTI in children. The underlying physiopathological alterations can last anywhere from 4 to 6 weeks. During this time, general anesthesia has been proven to increase the risk of perioperative respiratory adverse events (PRAEs) in children.[3] In pediatric anesthesia, PRAE is the most common complication. The respiratory adverse events (PRAE) associated with URI are bronchospasm, laryngospasm, breath holding, desaturation, reintubation, pneumonia, and unanticipated admission[1]. They have the potential to cause considerable neurological injury as a result of hypoxia.[4] They are present in more than a quarter of all youngsters who come in for surgery.[5] Children with a URTI have a 2–7 times greater incidence than children without a URTI, and if the trachea is intubated, the incidence rises to 11 times higher.[2] Their prevalence can lengthen hospital stays, raise hospital expenditures by up to 30%, and increase costs in outpatient settings.[6] PRAE that is severe enough might cause cardiac arrest and possibly death.[7] Because URTI occurs frequently, especially in young children and children undergoing ear, nose, and throat procedures, it

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is critical for the anesthetist in charge of these patients to choose an anesthetic strategy that minimizes the occurrence of PRAE. There is also clinical uncertainty about how long to postpone the procedure following a URTI. Furthermore, the cancellation of surgery has negative economic and emotional consequences.[8] In terms of treatment, children with recent URTI have bronchial hyper reactivity similar to that seen in asthmatic children, so the use of salbutamol in children with RTI has become popular among pediatric anesthetists for the prevention of PRAE, as the β-2 agonist salbutamol has been shown to be effective in preventing increases in total respiratory resistance and in decreasing total respiratory resistance.[9] Pre-operative salbutamol is routinely used, particularly in children with URTI, but its effectiveness in reducing the risk of PRAE is debatable.[10] The aim of this study was to evaluate the effect of salbutamol premedication on the incidence of PRAE in children with a recent URTI.

PATIENTS AND METHODS

Study Design, Setting, and Time

This was a randomized clinical trial study that conducted at Children Welfare Teaching Hospital for a period of 6 months from March 1, 2021, to September 1, 2021.

Study Population and Sample Size

The study included 90 children aged ≤16 years underwent surgical operation under general anesthesia with a laryngeal mask airway (LMA) or a tracheal tube. They were operated on as elective cases. Patients with cardiac diseases, thoracic malformations, neurological disorders, known sensitivity or contraindication to salbutamol or LMA, surgeries regarding ear, nose, throat, airway, and chest, children receiving only a face mask, and those whose parents were refused to participate were excluded from this study. All the patients' parents signed an informed consent that allows us to review their children medical records for research purposes as long as the patient anonymity and confidentiality of their medical records are maintained. They were divided into three groups:

- Group A: Included 30 patients had a recent URTI and received pre-operative salbutamol through a nebulizer 10–30 min before surgery (2.5 mg if weight <20 kg and 5 mg if weight >20 kg).
- Group B: Included 30 patients had a recent URTI and did not receive pre-operative salbutamol.
- Group C: IncluLded 30 patients had no URTI within the past 4 weeks.

Recent URTI defined as moist cough within the past 2 weeks before surgery as reported by the parents but no symptoms of a present infection. Detailed history was taken from each patient, physical examination, vital signs, and laboratory investigation were done.

Workup

Patients in Group A were given pre-operative salbutamol through nebulizer for 10–30 min before surgery. Atropine (0.01 mg/kg) was given to all of the youngsters as a preventative measure. Inhalational Sevoflurane or intravenous ketamine was used to produce anesthesia, and spontaneously breathing sevoflurane (2–5%) was used to sustain it in all cases. All of the children had their airways managed with an LMA. It was placed after the patient failed to respond to a bimanual jaw push procedure, indicating that he or she was deep enough. The LMA size was chosen based on pediatric anesthesia's typical weight sizing. Anesthesia monitoring was standardized (ECG, pulse oximetry, EtCO2, and non-invasive blood pressure). All respiratory adverse events in the perioperative period were recorded as listed in Table 1.[11] The preferred outcome was the difference in the rate of occurrence of PRAE between children having received salbutamol and those have not.

Statistical Analysis

The data analyzed using Statistical Package for the Social Sciences (SPSS) version 26. The data presented as mean, standard deviation, and ranges. Categorical data presented by frequencies and percentages. Chi-square test was used to assess the differences between study groups and PRAEs, while Fisher's exact test was used instead when the expected frequency was <5. A level of $P < 0.05$ was considered statistically significant.

RESULTS

In this study, all groups were not different in all characteristics regarding demographic and clinical, as shown in Table 2.

Table 1: List of PRAE recorded

PRAE	Definition
Bronchospasm	Occurrence of an increased respiratory effort, especially during expiration, and wheeze on auscultation
Laryngospasm	Complete airway obstruction with associated muscle rigidity of the abdominal and chest walls
Airway obstruction	Presence of airway obstruction in combination with a snoring noise and/or respiratory efforts
Severe coughing	A series of pronounced, persistent severe coughs lasting more than 10s
Desaturation<95%	Below 95%. The limit of 95% is chosen in line with institutional guidelines based on post-anesthesia care unit discharge criteria
Post-operative stridor	High pitch sound during breathing in the post-operative period

As shown in Table 3, 4 healthy children (13.3%) developed PRAE.

Table 4 shows the comparison in PRAE between study Groups A and B. We noticed that the incidence of bronchospasm and severe cough was significantly higher in patients with URTI and did not receive pre-operative salbutamol than that in those with URTI and received pre-operative salbutamol (26.7% vs. 6.7%, $P = 0.037$ and 33.3% vs. 10%, $P = 0.001$, respectively). However, No significant differences (i.e. : P ? 0.05) in incidence of laryngospasm and desaturation between two groups were observed.

DISCUSSION

The present study showed that children with the current and recent URTI have an increased risk of a PRAE than those who did not. A lot of studies discussed this relation and agreed with this result as in studies conducted by Michel *et al*. in France, 2018,[12] von Ungern-Sternberg *et al*. in Australia, 2007,[13] and Lema *et al*. in Ethiopia, 2018.[14] In children with URTI, PRAEs are the most common intraoperative and post-operative consequences.[15] The significantly greater prevalence of PRAE in children with a recent URTI could be related to airway inflammation, autonomic nervous system interaction, and subsequent airway sensitivity generated by the URTI.[16] Laryngospasm, bronchospasm, desaturation, severe coughing, and airway blockage are common PRAEs in children with URTI.[4] As a result, pre-operative evaluation and perioperative anesthetic care tailored to these children may be beneficial. Pre-operative information must be rigorously acquired for the optimum anesthetic administration, to limit the risk of PRAEs, while examining a child with a URTI who is scheduled for elective surgery. This study showed that the administration of inhaled salbutamol before surgery to children younger than 16 years with the current or recent URTI reduced the risk of PRAE from occurring and this is agreed with a study conducted by von Ungern-Sternberg *et al*. in Australia, 2008.[17] Because salbutamol has been shown to prevent the increase in respiratory resistance caused by tracheal intubation during sevoflurane anesthesia in asthmatic children,[18] the use of salbutamol in children with bronchial hyperactivity caused by a recent URTI most likely has the same underlying mechanism, resulting in a reduction in the incidence of respiratory adverse events as highlighted by this audit. Salbutamol's bronchodilatory actions are limited to the airway compartment of the lung, protecting against cholinergic-induced bronchoconstriction that occurs during anesthesia.[17] Disagreement was noticed in studies conducted by Elwood *et al*. in 2003[19] and by Baum *et al*. in 2003[20] when they failed to demonstrate the usefulness of a bronchodilator premedication (either ipratropium or albuterol) in reducing the incidence of PRAE. This could be due to the small number of children with modest URTIs who were included in the trials (e.g., sore throat). Furthermore, there was a lack of consistency in premedication selection (anti-cholinergic and b-2 agonist), and half of the children were sedated using a face mask, which may have concealed any b-2 agonist side effects. When compared to airway instrumentation with an endotracheal tube or an LMA, airway maintenance with a face mask minimizes the risk of PRAE because stimulation of the upper airways and, as a result, the parasympathetic system is eliminated, reducing the risk of PRAE.[17]

Table 2: Distribution of study groups by certain characteristics

Variable	Group A (%) *n*=30	Group B (%) *n*=30	Group C (%) *n*=30
Age (Year)			
<6	4 (13.3)	5 (16.7)	4 (13.3)
6–11	14 (46.7)	15 (50.0)	12 (40.0)
12–16	12 (40.0)	10 (33.3)	14 (46.7)
Gender			
Male	17 (56.7)	16 (53.3)	18 (60.0)
Female	13 (43.3)	14 (46.7)	12 (40.0)
History of asthma			
Yes	6 (20.0)	5 (16.7)	6 (20.0)
No	24 (80.0)	25 (83.3)	24 (80.0)
Airway device			
LMA	21 (70.0)	23 (76.7)	21 (70.0)
Tracheal tube	9 (30.0)	7 (23.3)	9 (30.0)
	Mean±SD	Mean±SD	Mean±SD
Weight	26.42±7.2	28.12±6.4	25.59±7.7
Duration of surgery (min)	63.55±12.4	59.58±14.3	60.22±9.8

Table 3: PRAE among healthy children (Group C)

PRAE in Group C	No. (*n*=30)	Percentage (%)
Laryngospasm	1	3.3
Desaturation	2	6.7
Severe coughing	1	3.3

Table 4: Incidence of PRAE in the study groups

PRAE	Study group		Total (%) *n*=60	P-Value
	A (%) *n*=30	B (%) *n*=30		
Laryngospasm	3 (10.0)	5 (16.7)	8 (13.3)	0.44
Bronchospasm	2 (6.7)	8 (26.7)	10 (16.7)	0.037
Desaturation	2 (6.7)	3 (10.0)	5 (8.3)	0.46
Severe cough	3 (10.0)	10 (33.3)	13 (21.7)	0.001

CONCLUSION

In conclusion, pre-operative salbutamol doses before 10–30 min of surgery have been demonstrated to reduce

and treat PRAEs. As a result, salbutamol pre-treatment in all children with URTIs who are undergoing surgery under general anesthesia should be considered.

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