Respiratory Complications in the Pediatric Postanesthesia Care Unit

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KEYWORDS

• Pediatric anesthesia • Respiratory complications • Risk factors
• Postanesthesia care unit • Recovery room

KEY POINTS

- Despite a good safety record, respiratory complications are a major cause of morbidity and mortality in pediatric anesthesia.
- 1 in 10 children present with 1 or more respiratory complications during their stay in the PACU.
- The risk factors can be divided into patient factors, surgical factors, and factors caused by anesthesia management.
- Rapid recognition of respiratory complications in the PACU and appropriate treatment strategies are essential to avoid hypoxia.

INTRODUCTION

Although pediatric anesthesia is relatively safe, perioperative respiratory adverse events (PRAE) are one of the major causes of morbidity and mortality.[1–6] A large audit in an academic center in Singapore showed that PRAE accounted for more than three-quarters of all critical incidents in pediatric anesthesia.[1] In addition, one-third of all perioperative cardiac arrests are caused by respiratory complications.[2] One-fifth of all perioperative cardiac arrests occur during emergence from anesthesia and in the postanesthesia care unit (PACU), with half of these the PACU arrests being caused by respiratory problems.[7] Furthermore, when comparing pediatric and adult closed-claim legal cases with respect to the mechanisms of injury and outcome, PRAE are more common and the rate is greater in pediatric claims that resulted in death

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(70%) or brain damage (30%) in previously healthy children compared with adult claims.[8,9]

A study by our group of more than 9000 children showed that 15% of all children suffered from 1 or more PRAE with oxygen desaturation; pulse oximeter saturation (SpO_2) less than 95% (10%), coughing (7%), airway obstruction (4%), and laryngospasm (4%) were the most common, whereas bronchospasm (2%) and postoperative stridor (<1%) were less common.[3]

Although PRAE may occur at any time in the perioperative period, they are most frequently observed during the induction of anesthesia and the recovery period.[3] Besides pain, emergence delirium, and postoperative nausea and vomiting, PRAE are the most common problems encountered in the PACU; however, above all, the most common reason for an emergency call from the PACU is the occurrence of PRAE.

Our goal should therefore be to predict (even before the induction of anesthesia) which children are at a particularly high risk for PRAE in the perioperative period, to then adjust our anesthesia management for the individual patient in order to minimize the occurrence and severity of PRAE during the entire perioperative period, including the stay in the PACU. Most respiratory complications, if treated immediately and effectively, are not associated with any long-term negative effects for the patient.

DEFINITIONS AND SIGNS OF PRAE

PRAE in the PACU include apnea, bronchospasm, laryngospasm, severe persistent coughing, oxygen desaturation, and stridor/postextubation croup, with the following definitions[10]:

1. Laryngospasm: complete airway obstruction associated with muscle rigidity of the abdominal and chest walls. Warning signs for the occurrence of laryngospasm are cough, breath holding, and straining in inspiration and expiration.
2. Bronchospasm: increased respiratory effort, particularly during expiration, and wheeze on auscultation; in extreme cases, a silent chest can occur, making the diagnosis more challenging.
3. Severe persistent coughing: a series of pronounced, persistent severe coughs lasting more than 10 seconds.
4. Partial and complete airway obstruction: erratic respiratory efforts in combination with stridor or a snoring noise or with paradoxic movement of the abdomen in the presence of partial and complete airway obstruction, respectively.
5. Apnea: cessation of gas flow for more than 10 to 15 seconds (varying definitions) or less if associated with bradycardia, cyanosis, or pallor. Apnea can be of either central (no gas flow because of lack of respiratory effort), obstructive (no gas flow despite respiratory effort), or mixed (central and obstructive) origin.
6. Oxygen desaturations: definitions vary between SpO_2 of lower than 90% and 95%. Desaturations can be the consequence of any of these signs and can lead to hypoxia and cardiac arrest.
7. Stridor: a high-pitched wheezing sound, resulting from turbulent airflow in the upper airway.

INCIDENCE OF PRAE

Recent data in our institution have shown that 1 in 10 children in the PACU present with 1 or more PRAE.[3] Although the incidence of bronchospasm and laryngospasm