Use of a Supraglottic Airway to Relieve Ventilation-Impeding Gastric Insufflation During Emergency Airway Management in an Infant

Kenneth W. Dodd, MD*; Ashley M. Strobel, MD; Brian E. Driver, MD; Robert F. Reardon, MD

*Corresponding Author. E-mail: kdoddmd@gmail.com, Twitter: @DoddMD.

Positive-pressure bag-valve-mask ventilation during emergency airway management often results in significant gastric insufflation, which may impede adequate ventilation and oxygenation. Current-generation supraglottic airways have beneficial features, such as channels for gastric decompression while ventilation is ongoing. A 5-week-old female infant required resuscitation for hypoxemic respiratory failure caused by rhinovirus with pneumonia. Bag-valve-mask ventilation led to gastric insufflation that compromised ventilation, thereby interfering with intubation because of precipitous oxygen desaturation during laryngoscopy. A current-generation supraglottic airway (LMA Supreme; Teleflex Inc, Morrisville, NC) was used to facilitate gastric decompression while ventilation and oxygenation was ongoing. After gastric decompression, ventilation was markedly improved and the pulse oxygen saturation improved to 100%. Intubation was successful on the next attempt, without oxygen desaturation. Current-generation supraglottic airways have 3 distinct advantages compared with first-generation supraglottic airways, which make them better devices for emergency airway management: gastric decompression ports, conduits for intubation, and higher oropharyngeal leak pressures. [Ann Emerg Med. 2016;68:452-455.]

0196-0644/$-see front matter

http://dx.doi.org/10.1016/j.annemergmed.2016.03.016

INTRODUCTION

Bag-valve-mask ventilation during resuscitation frequently leads to gastric insufflation, which may result in critically decreased lung compliance, arterial oxygenation, and carbon dioxide elimination.[1-3] The American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care state that during pediatric advanced life support, gastric decompression by passage of an orogastric tube may be conducted to relieve gastric insufflation.[3] But the current guidelines recommend doing this only after intubation. Passage of an orogastric tube during bag-valve-mask ventilation will interrupt ventilation and may introduce a route for passive regurgitation and aspiration.

In 2010, the American Heart Association guidelines for both neonatal and pediatric resuscitation incorporated the use of supraglottic airways, and in 2015 they recommended the use of supraglottic airways when bag-valve-mask ventilation is unsuccessful and intubation is not possible.[3,4] Supraglottic airways have been shown to provide safe and effective ventilation and oxygenation during pediatric and neonatal resuscitation.[5-8] In the hospital and emergency department (ED) setting, laryngeal mask airways have become popular backup devices, whereas King laryngeal tubes (King LT; King Systems Inc, Noblesville, IN) are primarily used in the out-of-hospital setting. Supraglottic airway design continues to advance, and current-generation devices provide distinct advantages over older models, such as gastric decompression ports, conduits for intubation, and higher oropharyngeal leak pressures. There are a few case reports describing the use of current-generation supraglottic airways in pediatric emergency airway management,[9,10] but the utility of the gastric decompression ports has not previously been reported in the emergency medicine literature, to our knowledge.

CASE REPORT

A 5-week-old, 4.5-kg, previously healthy, full-term, female infant born to a mother with negative group B *Streptococcus* result, with precipitate vaginal delivery with meconium staining but without evidence of aspiration at birth and uncomplicated postpartum hospital course, presented to the ED with 2 days of progressive cough and nasal congestion. The infant had decreased interest in nursing, but she continued to produce the same number of wet diapers. There was no fever, vomiting, diarrhea, lethargy, or seizurelike activity. Two siblings were ill with similar symptoms.

Initial examination revealed a well-appearing, afebrile (37.5°C rectal) infant with a pulse rate of 185 beats/min, respiratory rate of 35 breaths/min, and SpO_2 of 96% on

room air. The patient appeared alert and well nourished and was consolable in her mother's arms. There were no murmurs, retractions, irregular breathing, or adventitial lung sounds. Because of the patient's symptoms and relative hypoxemia, a chest radiograph was obtained and revealed a right upper lobe infiltrate consistent with pneumonia.

On reexamination, the patient was more lethargic and had a witnessed apneic episode, with her SpO_2 decreasing to 80% on room air. The episode resolved with tactile stimulation. Supplemental oxygen was administered and the patient was moved to the critical care area.

The patient continued to rapidly deteriorate, with her pulse rate increasing to greater than 200 beats/min and respiratory rate increasing to 45 to 55 breaths/min. There were repeated episodes of apnea with hypoxemia despite the administration of high-flow oxygen by face mask. Positive-pressure ventilation was performed with a properly sized bag-valve-mask device with a pressure release valve as preparations were made for intubation. After administration of atropine, succinylcholine, and etomidate, intubation was attempted with a Miller 1 blade and 3.5-mm uncuffed endotracheal tube, but the SpO_2 rapidly decreased from 95% to 65% and the attempt was aborted. Bag-valve-mask ventilation was then resumed, but it was not possible to increase the SpO_2 above 85%. Gastric distention with a taut abdomen was noted, and her treating physicians quickly recognized that gastric insufflation was impeding her respiratory dynamics.

A size 1 LMA Supreme (Teleflex Inc, Morrisville, NC) was inserted on the first attempt without difficulty and immediately improved ventilation, as evidenced by improved chest rise and SpO_2 of 92%. A 6-French orogastric tube was placed through the gastric port of the LMA Supreme without complication. This resulted in obvious gastric decompression. Within 1 minute of gastric decompression, the SpO_2 increased to 100%. After 2 minutes of ventilation and preoxygenation by the LMA Supreme, the device was removed and intubation was completed easily on the first attempt; the SpO_2 remained at 100% throughout the attempt. The endotracheal tube position was confirmed by auscultation, waveform capnography, bilateral sliding lung signs on ultrasonography, and chest radiography. Antibiotic and isotonic crystalloid therapy was administered, and the patient was transported to the pediatric ICU.

On laboratory examination, a CBC count showed a WBC count of 3,920 cells/μL, hemoglobin level of 11.6 g/dL, and platelet count of 296,000/μL. The patient remained intubated for 14 days. She was treated with broad-spectrum antibiotics and required vasopressor support for the majority of her ICU stay. Diagnostic evaluation revealed rhinovirus ribonucleic acid and rare *Haemophilus influenzae* from tracheal aspirate. She was discharged on hospital day 22. Her well child visit at 6 months demonstrated normal growth and development.

DISCUSSION

Although bag-valve-mask ventilation is widely considered the cornerstone of emergency airway management, it frequently leads to gastric insufflation, which increases pulmonary compliance and airway pressures that may prevent adequate ventilation and oxygenation, particularly in pediatric patients. Although passage of a nasogastric or orogastric tube will relieve gastric insufflation, this technique has historically required complete interruption of ventilation during the placement maneuver and is not currently recommended during resuscitation.[3]

The infant sustained ventilatory-impeding iatrogenic gastric insufflation from bag-valve-mask ventilation. Rapid oxygen desaturation forced ED providers to terminate their first intubation attempt. An appropriately sized LMA Supreme (Figure) was quickly inserted without difficulty. An orogastric tube was then placed through the LMA

Figure. The LMA Supreme supraglottic airway. The LMA Supreme is a current-generation supraglottic airway that incorporates a gastric port. An appropriate-sized orogastric tube can be placed through the gastric port and will emerge at the tip of the mask, which seats at the esophageal inlet and guides the tube into the esophagus. Image courtesy of Teleflex Incorporated.