SUCCESSFUL TRACHEAL INTUBATION THROUGH AN INTUBATING LARYNGEAL AIRWAY IN PEDIATRIC PATIENTS WITH AIRWAY HEMORRHAGE

Narasimhan Jagannathan, MD,* and David T. Wong, MD†

*Department of Pediatric Anesthesiology, Children’s Memorial Hospital, Northwestern University’s Feinberg School of Medicine, Chicago, Illinois; and †Department of Anesthesia, Toronto Western Hospital, University of Toronto, Toronto, Ontario

Abstract—Background: This case report describes the use of the air-Q intubating laryngeal airway (air-Q ILA; Cookgas LLC, St. Louis, MO) for airway rescue and a conduit for blind tracheal intubation in two pediatric patients with failed rapid sequence intubation and difficult airways secondary to airway bleeding in the emergency department (ED).

Objectives: To describe the use of a new supraglottic rescue device in the management of the pediatric patient’s difficult airway in the emergency setting.

Case Report: Case 1 was a 5-year-old boy who presented to the ED for bleeding one day after his tonsillectomy. After a rapid sequence intubation, direct laryngoscopy was difficult, with copious bleeding in the oropharynx and inability to visualize the glottis. After two failed direct laryngoscopic attempts to intubate, a size-2 air-Q ILA was inserted. A cuffed 5.0-mm inner diameter (ID) endotracheal tube (ETT) was blindly inserted through the lumen of the air-Q ILA into the trachea successfully.

Case 2 was a 13-year-old boy who presented to the ED with a large nasopharyngeal laceration from a motor vehicle accident. After a rapid sequence intubation, direct laryngoscopy showed copious blood with no glottic visualization. A size 3 Laryngeal Mask Airway Classic (cLMA; LMA North America Inc., San Diego, CA) was inserted with a large airway leak, and blind ETT insertion via the cLMA was unsuccessful. Subsequently, a size-2.5 air-Q ILA was inserted and adequate ventilation was restored. A cuffed 6.0-mm ID ETT was blindly inserted through the air-Q ILA into the trachea successfully.

Conclusion: Two cases of failed laryngoscopy in pediatric patients with blood in the airway are described. In each case, insertion of an air-Q ILA was followed by successful blind tracheal intubation via the lumen of the air-Q ILA. © 2010 Elsevier Inc.

Keywords—laryngeal mask airway (LMA); rapid sequence intubation; difficult airway in pediatrics; emergency airway in pediatrics; air-Q ILA; proseal LMA

INTRODUCTION

Although the development of the intubating laryngeal mask airway (LMA), the LMA-Fastrach (ILMA), and the LMA-CTrach (LMA North America Inc., San Diego, CA) have facilitated emergency tracheal intubation through a supraglottic airway in the unanticipated difficult airway in adults, such advancements have not been available for children (1–4). The air-Q intubating laryngeal airway (air-Q ILA) (Cookgas LLC, St. Louis, MO) is a new supraglottic airway recently introduced into pediatric practice. It shares common features with the LMA-Classic (cLMA) and the ILMA. It is inserted in the same manner as a cLMA while providing a conduit for tracheal intubation in a similar fashion as the ILMA (5). In contrast to the ILMA and LMA-CTrach, the air-Q ILA offers pediatric sizes appropriate for tracheal intubation in infants and children (6). These features make it potentially useful as a rescue airway device after failed tracheal intubation. Although rapid sequence intubation (RSI) in adult and pediatric patients in the emergency setting...
department (ED) is associated with a high degree of success in the hands of emergency physicians, sometimes there is a need to rescue the airway with either a supraglottic device or cricothyrotomy (7–11). The latter is more common in adult patients, and utilization of an emergent surgical airway is much rarer in the pediatric population (11,12). We report two cases of blind tracheal intubation performed successfully in the ED through the air-Q ILA in children after failed RSI with direct laryngoscopy.

**CASE REPORTS**

**Case 1**

A 5-year-old 28-kg boy presented to the ED of a small community hospital for bleeding 1 day after his tonsillectomy. At the time of the tonsillectomy, he had a Cormack and Lehane Grade II view (only the posterior portion of the glottis was seen; typically associated with easy tracheal intubation with direct laryngoscopy) upon direct laryngoscopy with a Miller 2 blade (13). He was obese and had a history of obstructive sleep apnea. In the ED, the patient’s blood pressure was 98/46 mm Hg and respiratory rate was 40 breaths/min while maintaining an oxygen saturation of 97% on 6 L oxygen via facemask. Our plan was to perform RSI with direct laryngoscopy with a gum elastic bougie, with access to an air-Q ILA for rescue ventilation and a conduit for tracheal intubation if direct laryngoscopy was unsuccessful. After RSI with ketamine and rocuronium, a laryngoscopic view with a Miller 3 blade was very difficult, revealing only copious blood in the posterior pharynx, despite aggressive suctioning. A size-3 cLMA was inserted easily, with an audible leak upon delivery of positive pressure. An attempt to blindly intubate through the cLMA with a 5.0-mm ID cuffed ETT was unsuccessful. The patient regained spontaneous breathing, and a surgeon remained at the bedside, ready to perform a surgical airway. The patient was maintaining SpO2 of 90%. After a second dose of thiopental and succinylcholine, the cLMA was removed and a size-2.5 disposable air-Q ILA was inserted as a last resort before proceeding to a surgical airway. Adequate ventilation with good chest rise was established with the air-Q ILA and no leak was noted. Because a fiberoptic bronchoscope was unavailable, a cuffed 6.0-mm ID ETT was blindly inserted into the trachea through the lumen of the air-Q ILA, which was successful upon the first attempt. Proper placement of the ETT was confirmed with end-tidal carbon dioxide, and the patient was taken to the operating room for repair of the laceration with the air-Q ILA left in situ.

Postoperatively, both intubated patients were taken to the Intensive Care Unit. Neither patient developed any serious respiratory sequelae or signs of aspiration. Both patients were discharged after uncomplicated recoveries.

**DISCUSSION**

Failed laryngoscopy and difficult mask ventilation are very rare in pediatric patients. A study of the National Emergency Airway Registry database found that only 0.56% of pediatric intubations require cricothyrotomy (7). This percentage may be decreased by adoption of RSI techniques, increased use of video-guided intubation, new difficult airway devices, and increased prevalence of residency-trained emergency physicians (14). The surgical airway is a rare event in the pediatric population, particularly in children under 8 years of age. The cricothyroid membrane in adults averages 13.7 mm in length and 12.4 mm in width (15,16). In contrast, in young infants, the cricothyroid membrane has a mean length of only 2.6 ± 0.7 mm and width of 3 ± 0.63 mm (17). Thus, there is a larger target for incision offered by the thin cricothyroid membrane in adult patients compared to pediatric patients. Anatomic factors in young infants such as a small cricothyroid membrane, which also has a different orientation than in adults, limits the size of a device that may be safely passed with minimal damage to the larynx (12,15–17). Furthermore, the hyoid bone and cricoid cartilage are often more prominent than the thyroid cartilage, making identification of anatomical landmarks and
relational anatomy more difficult to appreciate (12). This makes cricothyrotomy in young children technically more challenging, if not contraindicated, even in the hands of the experienced practitioner. The lack of availability of commercial cricothyrotomy kits for this age group, along with these age-specific anatomic factors, make it difficult to perform expeditious placement of a cricothyrotomy (12,17).

A supraglottic airway device can be used as a rescue airway for oxygenation and ventilation when traditional bag mask ventilation or tracheal intubation is difficult to perform (4,18). In pediatric patients, the most widely used and researched supraglottic airway for airway rescue is the cLMA (19,20). The proseal LMA (pLMA) is another supraglottic airway device used for airway rescue. This device incorporates the provision of an esophageal drain tube along with a larger mask bowl compared to the cLMA. Both the cLMA and the pLMA can be used as a conduit for tracheal intubation, but both are limited by the size of ETT that will fit the lumen, especially when using a cuffed ETT (6,21). Recently, a new supraglottic airway, the air-Q ILA, has been introduced into pediatric airway practice. It is available as a reusable device from size 2.0 to 4.5, and as a disposable device from size 1.0 to 4.5. The main features of the air-Q ILA are described in Figure 1.

Blind tracheal intubation through the air-Q ILA is conceptually identical to using the ILMA and involves the following steps: 1) the air-Q ILA is deflated and inserted using a rotational technique (Figure 2, A and B); 2) the cuff of the air-Q ILA is inflated according to the manufacturer's guidelines and ventilation is verified; 3) the air-Q ILA 15-mm airway connector is removed; 4) the ETT is reverse loaded through the lumen of the air-Q ILA into the trachea; and 5) ventilation through the ETT is verified (Figure 2, A–D). Removal of the air-Q ILA after tracheal intubation is optional and the clinician may leave the air-Q ILA in situ with the ETT. The rotational technique for inserting the air-Q ILA and the reverse loading of the ETT are illustrated and described in Figure 2, A–D.

We chose not to remove the air-Q ILA after tracheal intubation because there is always a risk of ETT dislodgement or extubation upon removal of a supraglottic device. This can be a serious problem in the face of a bleeding airway, especially when the airway was initially difficult to secure. If removal is desired after successful tracheal intubation through the air-Q ILA, the device can be removed using a manufactured removal stylet (22). Alternatively, if the removal stylet is unavailable, laryngeal forceps can be used to stabilize the ETT while withdrawing the air-Q ILA in a manner similar to removing the LMA.

There are several potential advantages of using the air-Q ILA compared to the cLMA or pLMA in the context of intubation. Structurally, in contrast to the cLMA, the air-Q ILA has advantages: a wider and deeper mask bowl designed to improve airway seal and anatomical alignment; a removable 15-mm connector; a shorter and wider shaft; and no aperture bars (Figure 1). In addition, the elevated ridge around a keyhole-shaped outlet and the auxiliary
Airway hole above it (Figure 1) help to prevent the epiglottis from being trapped and drawn into the ventilating orifice. These properties allow for epiglottic isolation and passage of a larger-bore ETT with a greater depth of penetration of the inserted ETT into the trachea. These design features, which aid in epiglottic isolation, may help the emergency physician when intubating through this device in younger children, in whom there is a higher incidence of epiglottic downfolding when a supraglottic airway is placed (23,24).

Lastly, mask ridges are incorporated into the front end of the mask bowl. When the bowl is inflated, these ridges move against the posterior larynx, improving the anterior mask seal. This helps isolate the esophagus, reducing the potential for aspiration.

However, like the cLMA, the air-Q ILA’s main limitation is its inability to drain stomach contents in non-fasted or full-stomach patients because there is no built-in provision for a drain tube as there is with the pLMA. Although the design features mentioned above may assist in aerodigestive separation, the manufacturers do not recommend the use of these devices for the prevention of aspiration of stomach contents. Therefore, the clinician must weigh the benefits of emergency airway needs against the potential risk of aspiration in these patients.

Both of these cases were encountered in a rural hospital setting without alternative airway equipment such as a fiberoptic bronchoscope, lighted stylet, or retrograde intubation set. Although we anticipated potential difficulty in laryngoscopy, we expected easy mask ventilation and, because the patency of both patients’ airways was unlikely to be reliant on their own muscle tone, paralysis was administered to obtain the most optimal view possible to facilitate direct laryngoscopy for RSI. We were able to place the air-Q ILA to oxygenate and ventilate, and subsequently to secure the airway with a cuffed ETT on the first attempt.
The aim of this case report was to highlight the role of the air-Q ILA as a rescue ventilatory device and as a conduit for tracheal intubation in pediatric patients after failed laryngoscopy. In our clinical experience of 50 pediatric patients, the success rate for blind tracheal intubation through the air-Q ILA was approximately 90% upon first pass. Further studies are necessary to confirm the success rate of tracheal intubation using the air-Q ILA, blind or bronchoscope-guided, compared to other supraglottic airway devices.

COtCLUSION

We present two cases of failed intubation with direct laryngoscopy in two children with airway bleeding after RSI in the ED. In each case, insertion of an air-Q ILA was followed by successful blind tracheal intubation via the lumen of the air-Q ILA. Although the cLMA or pLMA may permit reasonable rescue ventilation, neither allows the passage of an adequately sized cuffed ETT (Table 1).

REFERENCES