Reverse Air-Q Insertion: An Alternative to the Bailey Maneuver for a "Gentler" Extubation

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"Doctor, could you arrange for a smooth wake-up with little or no coughing?" asked the surgeon at the conclusion of a total thyroidectomy. "Yes." was the reply. "I've already arranged to remove her ETT prior to return of airway reflexes, and allow her to safely emerge from anesthesia with an SGA." Following the return of spontaneous ventilation yet prior to emergence, her ETT was removed. She was allowed to emerge from anesthesia without coughing or bucking, while the SGA permitted adequate airway support to prevent upper airway obstruction.

Use of an SGA in this fashion follows in the wake of the technique described by Dr. Paul Bailey, who created the "Bailey maneuver," which described the insertion of a laryngeal mask airway (LMA) (Classic or ProSeal) behind an indwelling ETT to serve as a bridge to extubation (using e.g. 0.5 mg/kg propofol). The SGA used during this total thyroidectomy was an Air-Q by Cookgas. Although this technique is reminiscent of the Bailey maneuver, what differs is intubating the patient using other laryngoscopy equipment and then deliberately placing the Air-Q in the patient for the entire operation until needed to serve as a bridge to extubation.

The Air-Q SGA was designed from its inception to serve as a conduit to intubation as well as extubation, notably due to its large oval-shaped respiratory gas tubing which is mated to a large keyhole-shaped outlet in the bowl of the mask. I recently began to use this alternative to the Bailey maneuver in my practice, utilizing the Air-Q's features as an intubating airway. In lieu of inserting the device *behind* the indwelling ETT, the Air-Q is inserted *over* the indwelling ETT utilizing the removal stylet supplied by the manufacturer. What is the principal difference and potential advantage of this method in comparison to the Bailey maneuver? This technique will allow exact alignment of the respiratory gas tubing outlet (the keyhole) to be in close and proper alignment with the larynx following the removal of the ETT, with the epiglottis in a non-obstructing position.

What is important to know about the timing of performing this technique is that it must be performed *before* the return of any airway reflexes.

The technique:

- Lubricate the interior and exterior of the Air-Q to permit for easy passage, and if desired, remove all of the air from the cuff of the Air-Q.
- Loosen the 15 mm connector on the indwelling ETT to permit the easy connection of the Air-Q removal stylet.
- Thoroughly suction the patient's oropharynx and loosen or remove the securing tape or other tracheal tube holding/restraining mechanism.
- Begin the procedure with the removal stylet threaded through the Air-Q airway (without its 15 mm connector), and place the pilot balloon of the indwelling ETT into the keyhole opening alongside the removal stylet.
- Grasp the pilot balloon with a hemostat once it is threaded proximally up the Air-Q tubing to permit this maneuver. • Leave the hemostat connected to the proximal hard plastic edge of the pilot balloon (Figure 1 and 2).

Fig 1 Load balloon to hole with blue stylet is next to it

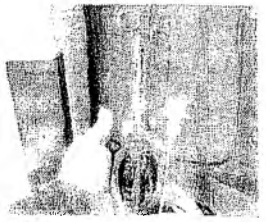

Fig 2 Forceps grasping positioned balloon

• Remove the 15 mm connector on the ETT and connect the removal stylet with a firm clockwise twist to ensure a solid connection—a second pair of hemostat forceps can be of assistance to gain the proper locking tension (Figure 3).
• Load the Air-Q over the ETT while maintaining steady traction on the removal stylet to avoid the natural tendency of the ETT to be advanced deeper into the trachea.

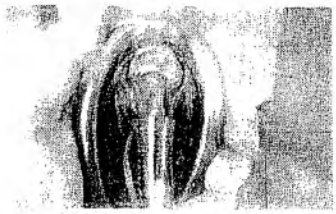

Fig 3 Stylet twist-locked into ETT

The first major goal of this procedure is to recover the pilot balloon through the proximal end of the tubing—as the Air-Q is advanced, the pilot balloon will be easily recovered through the proximal end of the tubing (Figure 4).
The second major goal is to seat the mask near the base of the tongue, while maintaining a proper ETT position.

Fig 4 Proximal Air-Q

• Following proper seating as well as inflation, the removal stylet can be disconnected from the ETT with a firm counterclockwise twist. Again, hemostat forceps can be of assistance (Figure 5).

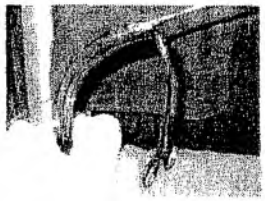

Fig 5 Advancing Air-Q over removal stylet

Reconnect the ETT's 15 mm connector and ventilate the patient (Fig 6).

Fig 6 Removal of stylet with forceps assistance

• Remove the ETT in the latter part of the surgery and later the Air-Q in a similar fashion to SGA removals following the Bailey maneuver. A recent use of this technique involved a 154 kg male undergoing an endovascular repair of an abdominal aortic aneurysm. The airway was initially managed with a rapid sequence direct laryngoscopy with a Pentax AWS video laryngoscope. Concerns over his emergence revolved around the potential for serious upper airway obstruction following tracheal extubation due to his large size and history of obstructive sleep apnea. Following emergence from anesthesia and tracheal extubation, this patient maintained a patent airway and spontaneous ventilation for upwards of 5 minutes until he could no longer tolerate the SGA and it was deemed it safe to remove it.

I recommend that this technique be initially simulated in an airway intubating mannequin, and that all surfaces receive ample lubrication so as not to foil the simulation and practice needed to make this procedure go smoothly. Practice the use of the removal stylet with an Air-Q airway in a mannequin—first, used as was intended by the manufacturer, i.e. removal of the Air-Q over an ETT. Then, reverse the process and place the Air-Q over the removal stylet and ETT, and you will quickly grasp the essence of this procedure.

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Utility of the Intubating Laryngeal Airway®: Report of an Observational Study

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Introduction:

The Intubating Laryngeal Airway® (Cookgas Inc, St. Louis, MO) is a new FDA-approved device designed for airway management, or as a conduit for endotracheal intubation. We wished to characterize the utility of the ILA via a non-randomized observational study in a structured series of cases.

Methods:

The Intubating Laryngeal Airway (ILA) was used for airway management in 28 patients scheduled for gynecologic surgery. The ILA was used as a conduit for endotracheal intubation in 22 patients. A fiberoptic bronchoscope (FOB) was passed down the lumen of the ILA following placement to evaluate its relationship to airway structures in the first 20 patients, and to facilitate endotracheal intubation in select patients. Blind passage of an endotracheal tube (ETT) was attempted in 6 of the first 20 patients, and in all of the final 8 patients. In the latter group, the FOB was only used to diagnose obstruction to blind passage (thrice), or to complete failed blind intubation (once).

In 5 patients, extubation was performed under deep anesthesia with the ILA in situ.

All procedures were captured on videotape in the first 20 patients.

Results:

The Intubating Laryngeal Airway was successfully placed on the first attempt in 27/28 patients. A large leak during manual ventilation was corrected in 2 patients by slight withrawal of the device.

When the FOB was used, the glottis was visualized and the trachea intubated every time. Some degree of epiglottic intrusion was observed on fiberoptic examination in most cases. However, the keyhole-shaped aperture allowed a space for the epiglottis to intrude into, allowing unimpeded ventilation and fiberoptic access to the glottis.

Two cases of malpositioning of the ILA (inserted too deep and laterally displaced respectively), and one case of complete epiglottic downfolding, all without impedance to ventilation, were observed. Epiglotic downfolding was corrected by jaw lift and withdrawal of the ILA, followed by reinsertion (dubbed the "Klein Maneuver").

Under fiberoptic visualization (FOB within lumen of endotracheal tube with no manipulation), a regular endotracheal tube (Mallinckrodt Inc, St. Louis, MO cat. no. 86111) failed to pass directly into the trachea in 3 instances. The more flexible Mallinckrodt Reinforced Tracheal Tube (Mallinckrodt Inc, cat. no. 86552) was advanced directly into the trachea under unguided fiberoptic visualization in 2 of 2 instances. Blind passage of the Mallinckrodt Reinforced Tracheal Tube into the trachea without benefit of a FOB was successful in 8 of 11 instances. In the 8 cases of successful blind passage, 3 passed without jaw lift, and 2 passed following the application of jaw lift. 3 passed on the first attempt following the correction of obstructions to advancement (a downfolded epiglottis, too deep insertion, and lateral displacement of the ILA respectively).

Of the 5 patients extubated under deep anesthesia, the ILA required manipulation to establish airway control in 1 patient, and provided a controlled airway in 4 patients. All 5 patients emerged smoothly from anesthesia without bucking or straining.

Conclusion: The Intubating Laryngeal Airway is effective as a device for airway management, and as a conduit for endotracheal intubation. Optimal techniques for blind intubation, and the utility of the device in difficult airway scenarios, warrants further study.

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Table 6. Supraglottic Ventilatory Devices

Name/Manufacturer	Description	Size	Clinical Applications	Special Features
LMA Classic (LMA North America, Inc)	Supraglottic ventilatory device that consists of an oval inflatable silicone cuff in continuity with a wide-bore tube that can be connected to an Ambu bag or anesthesia circuit. Designed to fit the pharynx of patients of various weights.	Adult and pediatric sizes 1-6, accommodating ET 3.5-7.0 mm.	Although originally developed for airway management of routine cases with spontaneous ventilation, it is now listed in the ASA Difficult Airway Algorithm as an airway ventilatory device or a conduit for endotracheal intubation.[1,13] Can be used in both pediatric and adult patients in whom ventilation with a face mask or intubation is difficult or impossible. Can also be used as a bridge to extubation[14] and with pressure support or PPV.[15]	Nondisposable and reusable.
LMA Flexible (LMA North America, Inc)	Original LMA cuff design attached to smaller-diameter, flexible armored tube that allows repositioning of the tube without cuff displacement. New single-use version is easier to insert.	Adult and pediatric sizes 2-6.	Particularly useful in ENT/head and neck procedures.	Both reusable and disposable versions now available. Airway tube resists kinking and cuff dislodgment, and thus may be positioned away from the surgical field without loss of seal.
LMA Unique (LMA North America, Inc)	Original, disposable LMA design. Sterile, latex-free, available with or without syringe and lubricant. Soft cuff and airway tube allow for conformity to patients' natural anatomy.	Adult and pediatric sizes 1-5.	Same as LMA Classic. Included in AHA 2000 Guidelines for CPR and Emergency Medicine Cardiovascular Care.	Single use.
LMA ProSeal (LMA North America, Inc)	Designed with a modified cuff and dual tubes to separate the respiratory/alimentary tracts. Has a built-in bite block.	Adult and pediatric sizes 1½-5.	Same as LMA Classic except drain tube also allows for evacuation of stomach contents.	Second cuff allows higher seal for PPV. Reusable.
LMA Supreme (LMA North America, Inc)	Has a gastric drain tube designed to suction the stomach, channel gases and fluids away from the airway, and confirm placement of the tip of mask at upper esophageal sphincter. The airway tube has a gentle curve and oblong shape to allow easier insertion and more stable placement.	Adult sizes 3-5.	Same as LMA ProSeal.	A single-use LMA with a redesigned mask that achieves a 50% higher seal pressure than the Classic or Unique. Similar to all LMAs, the Supreme is designed to protect the airway from epiglottic obstruction—in this model with molded fins in the bowl of the mask.

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Table 6. Supraglottic Ventilatory Devices (continued)

Name/Manufacturer	Description	Size	Clinical Applications	Special Features
LMA Fastrach (LMA North America, Inc)	Consists of a mask attached to a rigid stainless steel tube curved to align the barrel aperture to the glottic vestibule. The set includes an LMA with a stainless steel shaft covered with silicone (reusable version) and a single movable epiglottic elevating bar, ET stabilizer, and silicone wire-reinforced ET. The single-use Fastrach is made from PVC and includes a disposable wire-reinforced ET.	Adult sizes 3-5 that can accommodate special ETs 6.0-8.0 mm.	Useful for ventilation and intubation. Designed for blind orotracheal intubation but can be used in conjunction with lighted stylets, FOB, or Flexible Airway Scope Tool. FOB recommended when using PVC ET.	Both reusable and disposable versions now available. Can be utilized as a blind or visually guided technique. Benefits include ability to intubate with larger ET and remove the device easily over the ET.
LMA CTrach (LMA North America)	The LMA CTrach is an LMA Fastrach with built-in fiber optics that allow for ventilation, visualization, and intubation of the trachea. It includes an airway (made of silicone) that is similar to the Fastrach, with an attachable lightweight viewer.	Adult sizes 3-5 for patients ≥30 kg. Comes with Fastrach ETs 6.0-8.0 mm.	Useful in unanticipated and anticipated difficult airways. Allows for continuous ventilation during intubation attempts. Provides a direct view of the larynx and real-time visualization of the ET passing through the vocal cords.	Reusable only. Comes with 3 airways, a viewer, charger, 5 ETs, and stabilizer rods.
Soft-Seal Laryngeal Mask (Smiths Medical ASD/Smiths Medical International)	Similar in shape to the LMA Unique, but differs in its 1-piece design, in which the cuff is softer and there is no "step" between the tube and the cuff, an integrated inflation line, no epiglottic bars on the anterior surface of the cuff, and a wider ventilation orifice.	Adult and pediatric sizes 1-5.	Same as LMA Classic. Allows easy access for flexible fiberoptic devices.	If intubation becomes necessary or desired, will accommodate up to a 7.5-mm ET. Single-use.
Ambu AuraOnce (formerly the Ambu Laryngeal Mask; Ambu Inc)	A laryngeal mask with a special built-in curve that replicates natural human anatomy. It is molded in 1 piece with an integrated inflation line and no epiglottic bars on the anterior surface of the cuff.	Adult and pediatric sizes 1-5.	Same as LMA Classic. Allows easy access for flexible fiberoptic devices.	Anatomically correct curve and reinforced tip that facilitates placement. If intubation becomes necessary or desired, recommend intubation over Aintree AEC. Single-use.
Ambu AuraOnce Standard (Ambu Inc)	Similar to the LMA Unique but without epiglottic bars on the anterior surface of the cuff.	Adult and pediatric sizes 1-5.	Same as Ambu AuraOnce.	Single-use. Available only in the United States.
Ambu Aura40 (Ambu Inc)	Same design as the Ambu AuraOnce, but reusable.	Adult and pediatric sizes 1-6.	Same as Ambu AuraOnce.	Same as Ambu AuraOnce, but reusable.
Ambu Aura40 Standard (Ambu Inc)	Similar to the LMA Classic. No epiglottic bars on the anterior surface of the cuff.	Adult and pediatric sizes 1-6.	Same as Ambu AuraOnce.	Reusable. Available only in the United States.

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Table 6. Supraglottic Ventilatory Devices (continued)

Name/Manufacturer	Description	Size	Clinical Applications	Specific Features
Air-Q Reusable Laryngeal Mask (formerly the Intubating Laryngeal Airway; Cookgas LLC; distributed by Mercury Medical)	Hypercurved intubating laryngeal airway that resists kinking, and removable airway connector. Anterior portion of mask is recessed; a larger mask cavity allows intubation using standard ETs. Air-Q removal after intubation is accomplished by using Air-Q reusable removal stylet.	Adult sizes (2.5, 3.5, and 4.5) that can accommodate ETs 5.5-8.5 mm.	Similar to both LMA Classic and LMA Fastrach. Allows easy access for flexible fiber-optic devices.	Designed to minimize folding of the cuff tip on insertion. Same use and benefits as LMA Classic and LMA Fastrach.
Air-Q Disposable Laryngeal Mask (Cookgas LLC; distributed by Mercury Medical)	Same features as Air-Q Reusable Laryngeal Mask, except disposable.	Adult sizes (1.5, 2.5, 3.5, and 4.5) that can accommodate ETs 5.0-8.5 mm.	Same as Air-Q Reusable Laryngeal Mask.	Same as Air-Q Reusable Laryngeal Mask, but disposable.
CobraPLA Perilaryngeal Airway (Engineered Medical Systems)	Large ID laryngeal tube, which is soft and flexible in design with a tapered, striated tip. Now has an improved distal curve, softer tube, and softer head. It has a high-volume, low-pressure oropharyngeal cuff.	Adult and pediatric sizes ½-6.	Same as LMA Classic.	Disposable. If intubation becomes necessary or desired, will accommodate up to an 8.0-mm ET. Single-use.
CobraPLUS (Engineered Medical Systems)	Similar to the CobraPLA. Includes temperature monitor (all sizes) and distal gas sampling (pediatric sizes only: ½, 1, and 1½).	Adult and pediatric sizes ½-6.	Same as LMA Classic. An added benefit is the ability to measure core temperature. In addition, distal CO_2 can be monitored in the pediatric population.	Similar to CobraPLA, but CobraPLUS allows monitoring of the patient's core temperature. In neonatal and infant patients, CobraPLUS has the ability to increase the accuracy of end-tidal CO_2 and volatile gas analysis.
SLIPA Streamlined Liner of the Pharynx Airway (SLIPA Medical Ltd)	Similar to the LMA Unique.	Six adult sizes that relate to the dimension across thyroid cartilage cornu: 47, 49, 51, 53, 55, and 57 mm.	Same as LMA Classic.	Its hollow structure allows storage of regurgitant liquids, minimizing aspiration risk.[1] More confident placement by first-time users.[2] Single-use. Distributed in the United States by ARC Medical Ltd.
KING LT (King Systems Corp/VBM Medizintechnik GmbH)	Multi-use, latex-free, single-lumen silicon tube with oropharyngeal and esophageal low-pressure cuffs, 2 ventilation outlets, insertion marks, and a blind distal tip (almost like a single-lumen, shortened Combitube).[16] Color-coded connectors for each size.	Sizes 3-5 available worldwide; sizes 0-2 currently available only outside the United States and Canada.	Same as LMA Classic, but with ventilatory seal characteristics like those of LMA ProSeal.	Easily inserted, possible aspiration protection, and allows both PPV and spontaneous breathing. Nondisposable and reusable (up to 50 times).
KING LT-D (King Systems Corp/VBM Medizintechnik GmbH)	Same design as the KING LT, except disposable.	Adult sizes (3-5). Pediatric sizes (2, 2.5).	Same as KING LT.	Same as KING LT, but disposable. Also available in an EMS kit.

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Table 6. Supraglottic Ventilatory Devices (continued)

Name/Manufacturer	Description	Size	Clinical Applications	Special Features
KING LTS (King Systems Corp/VBM Medizintechnik GmbH)	Double-lumen laryngeal tube that incorporates a second (esophageal) lumen posterior to the ventilation lumen.	Adult sizes (3-5) and pediatric sizes (0, 1, 2, 2.5) currently available only outside the United States and Canada	Same as KING LT, except that it has a second lumen for gastric access, similar to LMA ProSeal.	Allows easy passage of a gastric tube to evacuate stomach. Distal tip reduced in size to facilitate insertion. Reusable.
KING LTS-D (King Systems Corp/VBM Medizintechnik GmbH)	Same as KING LTS, except disposable.	Adult sizes (3-5).	Same as KING LTS.	Same as KING LTS, but disposable. Allows passage of 18 Fr gastric tube. Also available in an EMS kit.
Esophageal Tracheal Combitube (Covidien, formerly Tyco Healthcare/ Mallinckrodt Nellcor Puritan Bennett)	A disposable double-lumen tube that combines the features of a conventional ET with those of an esophageal obturator airway. Has a large proximal latex oropharyngeal balloon and a distal esophageal low-pressure cuff with 8 ventilatory holes in between.	Two adult sizes. 41 Fr: height >5 ft. 37 Fr: height 4-6 ft.	Same as LMA Classic. Appropriate for prehospital, intraoperative, and emergency use. Especially useful for patients in whom direct visualization of the vocal cords is not possible, patients with massive airway bleeding or regurgitation, limited access to the airway, and patients in whom neck movement is contraindicated.	Ventilation is possible with either tracheal or esophageal intubation. Distal cuff seals off the esophagus to prevent aspiration of gastric contents. Allows passage of an orogastric tube when placed in the esophagus. Single-use.
ChouAirway (Achi Corp)	Adjustable oropharyngeal airway of 2-piece construction. The rigid outer tube serves as a conduit for and protects the flexible inner tube, which creates a patent air passage from the mouth opening to the glottis.	Adult (10-13 cm) and large adult (13.5-16.5 cm) sizes.	In conjunction with a face mask, it is placed orally to facilitate and maintain spontaneous or assisted breathing.	The inner tube is longer than other common oral airways, and thus capable of reaching beyond the base of the tongue in patients with a short ramus or large tongue. Single-use.
Intersurgical i-gel (Intersurgical Ltd)	Disposable supraglottic airway with noninflatable cuff designed to match the perilaryngeal anatomy. Incorporates an integral bite block and gastric channel.	Adult sizes (3-5) that can incorporate ET sizes 6.0-8.0 mm and nasogastric tube sizes 12-14 Fr.	Similar to other supraglottic airways, except drain tube allows evacuation of stomach contents.	Noninflatable cuff allows easy and rapid insertion, minimal risk for tissue compression, and stability after insertion. Gastric channel allows suctioning of stomach contents, insertion of a nasogastric tube, and facilitation of venting. Epiglottis blocker minimizes the risk for epiglottis downfolding. Buccal cavity stabilizer reduces the risk for malposition and aids insertion. Single-use. Available only in the European Union.

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Case report

The new air-Q™ intubating laryngeal airway for tracheal intubation in children with anticipated difficult airway: a case series

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Summary

The air-Q intubating laryngeal airway (ILA) is a new supraglottic airway device which may overcome some limitations inherent to the classic laryngeal mask airway for tracheal intubation. We present a case series of patients with anticipated difficult airway in whom the air-Q ILA was successfully used as a conduit for fiberoptic intubation.

The laryngeal mask airway (LMA™; LMA North America, Inc., San Diego, CA, USA) has been demonstrated to be effective as a conduit for tracheal intubation in pediatric patients with a difficult airway (1–4). Although development of the LMA-Fastrach™ and LMA-CTrach™ have facilitated LMA-assisted tracheal intubations in both elective and emergent difficult airway scenarios in adults, such advancements have not yet been available for children. The main advantages of LMA-assisted tracheal intubation are (i) ease of placement, (ii) reliable alignment of the glottic opening, (iii) the ability to continuously oxygenate and ventilate, and (iv) minimizing disconnection time from the breathing circuit (5). However, utilizing the classic LMA for tracheal intubation in neonates and children has some limitations, and modification of the LMA and/or tracheal tube (TT) may have to be made for a successful intubation (1,6,7).

The air-Q ILA™ intubating laryngeal airway (ILA) (Cookgas, St. Louis, MO, USA), a new supraglottic airway device, may overcome these limitations inherent to the classic LMA for tracheal intubation. Advantages of the air-Q ILA over the classic LMA include: (i) a shorter, more curved shaft, (ii) an easily removable airway adapter, (iii) lack of a grill in the ventilating orifice, and (iv) the ability to remove the laryngeal airway after tracheal intubation with or without a stabilizing rod. (Figure 1) We present a case series of patients with anticipated difficult airway in whom the air-Q ILA was successfully used as a conduit for fiberoptic intubation.

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Case report

Patient no. 1

A 2-year-old boy with Hurler's syndrome was to undergo ventriculo-peritoneal shunt revision. Two months earlier, the patient had been difficult to ventilate after inhalation induction. A Cormack and Lehane Grade IV (C&L IV) was noted upon direct laryngoscopy. Subsequently, a no. 2 classic LMA was placed revealing a C&L II view of the glottis through a fiberoptic bronchoscope, and the patient was successfully intubated with a 4.0 uncuffed TT via the no. 2 LMA. Current airway examination

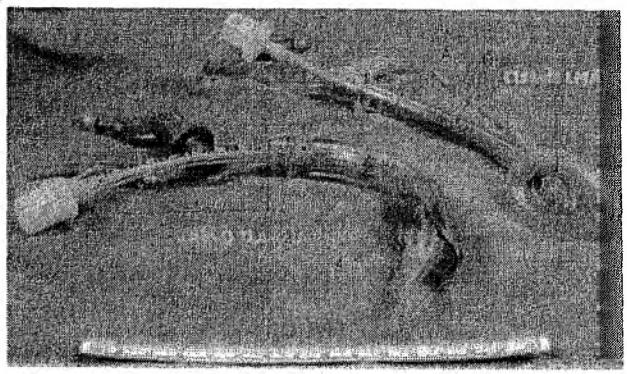

Figure 1
Size #1.5 air-Q™ intubating laryngeal airway (ILA) (bottom) versus Size #2 classic laryngeal mask airway (LMA) (top). 1, removable airway adapter; 2, longer tracheal tube (TT) length external to the air-Q ILA; 3, shorter, curved shaft; 4, airway outlet without grill; 5, recessed front; A, nonremovable airway adapter with narrower lumen; B, shorter TT length external to the LMA; C, longer, straighter shaft; D, airway outlet with grill; E, nonrecessed front.

revealed a limited oropharyngeal space secondary to mucopolysaccharide deposits resulting in a mouth opening of 12 mm. Intramuscular ketamine 3 $mg \cdot kg^{-1}$ was administered, and intravenous (IV) access was established. When positive pressure ventilation was adequate, paralysis was instituted with rocuronium. A size 1.5 air-Q ILA was inserted with a leak pressure of 24 cm H_2O followed by fiberoptic-assisted tracheal intubation with a 4.0 mm ID cuffed TT.

Patient no. 2

A 2-year-old girl with a large bilateral maxillo-mandibular dysplastic mass presented for excision. Interval computerized tomography (CT) scans revealed an expanding fibrous mass involving both the maxilla and the mandible. Previous anesthetic records documented an easy mask induction and placement of a no. 1.5 LMA for the CT scans. Her mouth opening was now less than 2 cm. Inhalation induction was performed with sevoflurane in oxygen, and positive pressure ventilation was instituted. IV access was obtained and paralysis was established with rocuronium. An air-Q ILA size 1.5 was placed with a leak pressure of 26 cm H_2O and the patient was intubated with a 4.5 ID cuffed TT over a fiberoptic scope.

Patient no. 3

A 6-year-old boy with Treacher-Collins syndrome was to undergo dental extractions. For a previous mandibular distraction surgery, mask ventilation was noted to be easy and an oral fiberoptic intubation was successfully accomplished using an Olympus™ LF-P (Olympus America Inc., Center Valley, PA, USA), although difficult secondary to a large epiglottis. Airway examination revealed a mouth opening of 13 mm with significant micrognathia. Anesthesia was the same as described above for patient no. 2. An air-Q ILA size 1.5 was placed without difficulty, with a leak pressure of 30 cm H_2O and the patient was intubated with a 5.0 ID cuffed TT using a fiberoptic scope.

Patient no. 4

A 7-year-old boy with Goldenhar syndrome was scheduled for mandibular distraction. Prior history was significant for easy mask ventilation, but limited visualization by direct laryngoscopy (C&L III) and difficult tracheal intubation. Airway examination revealed a limited mouth opening of 15 mm and micrognathia. The patient was sedated with 70% nitrous oxide in oxygen and an IV was placed. Anesthetic induction was achieved with propofol. Rocuronium was administered once positive pressure ventilation was verified. An air-Q ILA size 2 was placed with a leak pressure of 26 cm H_2O and the patient was intubated with a 5.5 ID cuffed TT and a fiberoptic scope.

Patient no. 5

A 16-month-old girl with Hunter's syndrome presented for magnetic resonance imaging of the brain and spine. At 10 months of age she was found to have limited visualization upon direct laryngoscopy (C&L IV). She was a difficult intubation and was intubated with a fiberoptic scope with a 3.5 uncuffed TT through a no. 1.5 LMA (C&L II view) for a ventriculo-peritoneal shunt placement. Present airway examination revealed a limited oropharyngeal space due to mucopolysaccharide deposits. Anesthesia was the same as described above for patient no. 1. A size 1 air-Q ILA was placed with a leak pressure of 28 cm H_2O and the patient was

intubated with a 4.0 mm ID cuffed TT using a fiberoptic scope.

Technique for securing the airway

All patients received 10 mcg·kg^{-1} of IV glycopyrrolate to minimize secretions after vascular access was established. The air-Q ILA was deflated and inserted using a rotational technique. The cuff of the air-Q ILA was inflated according to the manufacturer's instructions: Size 1 required <3 ml, size 1.5 required <5 ml, and size 2 required 5–10 ml. Our goal was to achieve a minimum leak of 20 cm H_2O while staying within the manufacturer's guidelines for cuff inflation. Leak pressures were obtained by auscultation over the anterior neck while observing the ventilator manometer during a positive pressure breath. After this determination, mechanical ventilation of about 10 ml·kg^{-1} using pressure-limited ventilation was instituted. The airway adapter of the air-Q ILA was removed prior to proceeding with a fiberoptic-assisted intubation. With an Olympus™ LF-DP fiberoptic scope (3.1 mm OD) (Olympus America Inc., Melville, NY, USA), a TT was loaded on to the fiberoptic scope prior to insertion into the trachea. The patients were then ventilated through the TT still within the air-Q ILA to verify bilateral breath sounds and endtidal carbon dioxide. The air-Q ILA was easily removed without the aid of a 'pusher' or stabilizing rod after intubation. Removal of the air-Q ILA required: (i) removal of the TT adapter, (ii) complete deflation of the air-Q ILA, (iii) downward traction on the TT, and (iv) distal control of the TT with the forefinger and thumb, while withdrawing the laryngeal airway. At the end of surgery, all patients were successfully extubated over an airway exchange catheter (AEC) (Cook Medical; Bloomington, IN, USA). Table 1 summarizes the cases and patient characteristics.

Discussion

Although the classic LMA has been a cornerstone in the management of the difficult pediatric airway, there are some limitations when it is used as a conduit for intubation. First, the shaft of the LMA can be as long as the TT making it difficult to maintain control of the TT while removing the LMA. Either a long tracheal tube (8), a double tracheal tube assembly (6,7,9), or a stabilizing rod is required to overcome the length of the LMA. A stabilizing rod is not available for the classic LMA as is seen with the adult ILMA's. These methods can be utilized to decrease the likelihood of accidental extubation of the TT during removal of the LMA. Shortening the shaft of the LMA (10) or leaving the LMA in place (4,11) for the duration of surgery have also been suggested to minimize these potential risks. Second, the airway connector of the LMA is not wide enough to allow passage of the cuffed TT pilot balloon. This would result in the pilot balloon 'hanging up' within the shaft of the LMA and potentially breaking upon attempted withdrawal of the LMA (9). Third, when using disposable LMA's, the grill may have to be cut to permit a larger or cuffed TT when compared with its nondisposable counterpart (12) (Table 2).

Table 1
Patient characteristics and a comparison of maximum tracheal tube (TT) sizes in the air-Q intubating laryngeal airway (ILA)™ vs the classic laryngeal mask airway (LMA)™

Patient (no.)	*Age*	*Weight (kg)*	*Cause of difficult airway*	*Mouth opening between incisors (mm)*	*Size of air-Q ILA™ placed*	*Leak pressure (cm H_2O) after air-Q ILA™ placement*	*Cuffed TT size placed (mm ID)*	*Maximum cuffed TT size (mm ID) permitted by the air-Q ILA™*	*Maximum uncuffed TT size (mm ID) permitted by the same sized LMA™*
1	2 y	12	Hurler's syndrome	12	1.5	24	4.0	5.0	4.0
2	2 y	16	Maxillo-mandibular mass	20	1.5	30	4.5	5.0	4.0
3	6 y	22	Treacher-Collins syndrome	13	1.5	26	5.0	5.0	4.0
4	7 y	27	Goldenhar syndrome	15	2	26	5.5	5.5	4.5
5	16 m	10	Hunter's syndrome	16	1	28	4.0	4.0	3.5

kg, kilogram; mm, millimeters; ID, internal diameter; y, year; m, months.

Table 2
A practical comparison of the classic laryngeal mask airway (LMA) to the air-Q intubating laryngeal airway (ILA) as a conduit for tracheal intubation in children

Features	*Classic LMA*	*Air-Q ILA*
Shaft	Straighter; can be as long as the TT	Shorter and curved; allows for greater control of the TT
Grill	Present; may need to be cut in the disposable versions	Absent
TT Sizes	Only a narrow range of TT sizes will fit through the LMA	Can accommodate a larger range of cuffed and uncuffed TT's as compared with an equivalently sized LMA, both based on body weight recommendations
Passage of TT pilot balloon	'Hang up' within shaft upon withdrawal of LMA	Removable adapter allows easy passage upon removal of air-Q ILA
Withdrawal of device when cuffed TT's are used	More difficult; may require extra equipment (forceps, 2nd TT) or modification of LMA	Easy; a stabilizing rod is also available

TT, tracheal tube.

The Air-Q ILA has several key structural differences from the classic LMA; therefore, it has the potential to overcome the limitations of the classic LMA. As the shaft of this airway is much shorter and curved, enough of the proximal TT is still above the shaft, allowing for removal of the air-Q ILA without the aid of a stabilizing rod. If desired, the clinician can easily remove the air-Q ILA using a specially designed removal stylet to prevent dislodging the TT. In our series, we were able to remove the air-Q ILA without the use of this stylet to stabilize the TT in the larynx. The airway connector of the air-Q ILA is easily removable eliminating this potential area where the pilot balloon of the TT can get stuck. A grill is not present in the air-Q ILA and pediatric sizes 1, 1.5, 2, and 2.5 can accommodate up to cuffed TT sizes of 4.0, 5.0, 5.5, and 6.0 mm ID respectively. This issue is clinically applicable in patients with a limitation in mouth opening in whom only smaller laryngeal airways may fit while still needing to place a size appropriate cuffed TT.

We found the rotational insertion technique of the deflated air-Q ILA the most successful. Prior to conducting this case series, we placed several air-Q ILA's electively in children with normal airways and found this to be easiest. In all our patients the TT was inserted into the trachea on the first attempt with no decrease in oxygen saturation. An AEC was placed through the TT prior to extubation as a means to re-intubate if needed. The AEC was removed when the patient exhibited adequate respiratory effort, facial grimacing, and hip flexion. There were no postoperative airway complications in any of the patients.

The air-Q ILA is available in six sizes (1, 1.5, 2, 2.5, 3.5, 4.5) for single use and four sizes (2.0, 2.5, 3.5, and 4.5) for reusable use. Sizing of the pediatric air-Q ILA is similar to the LMA in that it is weight-based: A size 1 is designed for patients <5 kg, size 1.5 for 5–10 kg, size 2 for 10–20 kg. In our case series, various cuffed TT sizes can be placed through the same size air-Q ILA as seen with patients no. 1–3. (Table 1) all of our patients demonstrate that a smaller than weight-based size air-Q ILA can be used without compromising ventilation parameters and allow for tracheal intubation with an appropriately sized cuffed TT. This would not have been possible with an equivalently sized classic LMA. The shaft of the classic LMA does not permit passage of a larger diameter TT or the pilot balloon of a cuffed TT (Table 1).

Patients no. 1 and no. 5 were intubated through both the classic LMA as well as the air-Q ILA providing a comparison. The superior glottic views seen with the air-Q ILA may be the result of features designed to lift the epiglottis and improve airway alignment (Figure 1).

There are however some limitations to the air-Q ILA. It may not improve the view when used in conjunction with a flexible fiberoptic scope in the presence of blood and secretions. Even in this situation, the alignment with the glottic anatomy may allow for increased success in the use of a 'light guided' or blind techniques for intubation. This device is of limited value in nasotracheal intubations and patients with no mouth opening. When intubating neonates, if a continuous ventilation technique is employed as described by Weiss (7) a standard bronchoscope adapter will add length to the shaft of the air-Q ILA, necessitating the use of a stablizing rod. Once the air-Q ILA airway connector is removed, the bronchoscope

Success of ventilation and intubation through "Air-Q"

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Abstract

Air-Q is a new supraglottic airway, wich has been introduced recently. This device is characterized by a performed shape and a wide airway conduit, these features allows sufficient ventilation & also intubation through the device.

Air-Q inserts smoothly and saves a supraglottic airway in general anesthesia with low *potential for traumatization. It can be used as a facilitator of blind intubation.*

Air-Q is designed for smooth placement, to allow easier insertion and therefore safe ventilation & if required, for comfortable blind intubating conditions.

Backed up by the presence of a flexible fiberscope, this device might be a useful alternative for the handling of difficult airway. Therefore, this intubating laryngeal airway(Air-Q)is an effective device for airway management, and as a conduit for endotracheal intubation. It can be considered in patients with difficult airways as a primary route of intubation or as a secondary rescue strategy. It can be used in operating room, emergency department and especially pre-hospital situations(EMS). In this article some experiences of authors in comparison with the other supraglottic airways will comprehensively discussed.

Key Words: Air-Q, laryngeal airway, difficult airway, supraglottic airway

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Ventilation and Fiberoptic Evaluation of Blind Intubation through AirQ: Experience on 60 Patients

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Background: AirQ (Mercury Medical, FL, USA) is a recently developed extraglottic LMA-type device with a preformed shape and a wide airway conduit with detachable 22 mm proximal connector. These feature should allow intubation through the device; aim of this study was to evaluate ventilation and intubation success by fiberoptic (FOB) tube position control.

Methods: after informed consent 60 patients (ASA I-II, 37 male, 23 female, undergoing major/minor abdominal surgery, no cases of predicted difficult ventilation/intubation accordingly to Italian Difficult Airway Management Guidelines) received the same anaesthesia protocol: preoxygenation in 100% O2 followed by administration of propofol 2 mg*kg-1, fentanyl 1.5 mcg*kg-1 and cis-atracurium 0.2 mg*kg-1.

A #5 AirQ was positioned with inflated cuff after 2 minutes and ventilation was checked via air leak test on APL valve and inspired-expired tidal volume differential (Aestiva SA-5 ventilator with dedicated monitor – GEHC, Helsinki, FI); repositioning was performed if ventilation was ineffective. A lubricated 8 mm ID endotracheal tube (ET) was then introduced through AirQ until a pre-signed mark corresponding to the ET tip completely out of AirQ airway conduit. FOB was then inserted into ET to assess position in front of the larynx. FOB was removed, blind intubation was attempted and checked with sidestream CO2 and new fiberoptic control. FOB-controlled position was graded as complete (CA), partial (PA) and missed alignment (MA) correspondingly to the relative position of ET tip in front of glottic opening. Insertion, ventilation and intubation success, desaturation or adverse events were recorded.

Results: Correct positioning was performed in 54/60 cases at first and in 60/60 at second attempt; ventilation was satisfactory (mean leak pressure at 21.8+/-3.4 cmH2O; Tvi-Tve 50.5+/-12.7 ml) in 48 patients at first record, 51 after further cuff inflation, 56 after device manipulation and 57 after reintroduction (1 case). In 3 patients ventilation was ineffective because of air leak and gastric insufflation (intubation performed anyway). Alignment was CA=39, PA=15 and MA=6 patients. Intubation was blindly performed at first attempt in 43 patients; after device and ET manipulation 11 patients were intubated during a second attempt while 6 cases the patient was intubated by repositioning the FOB and railroading the ET into the glottic opening (2 PA, 4 MA). No cases of desaturation were recorded.

Conclusions: AirQ resulted effective in terms of positioning and ventilation (overall success 95%), locating this device as safe alternatives for failed face-mask ventilation. Blind intubation success at first attempt was relatively high (71,6%), with a high number of alignments between ET and glottic opening (65% CA, 25% PA). Probably better results might be obtained after further training and with a longer learning curve, so larger studies are needed to confirm effectiveness of this new promising device.

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Success of blind intubation through the AirQ: a fiberoptic study on 10 patients

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Aim. AirQ (Mercury Medical, FL, USA) is a recently developed extraglottic LMA-type device characterized by a preformed shape and a wide airway conduit with a detachable 22 mm connector in the proximal end. These feature should allow intubation through the device; aim of this study was to evaluate blind intubation success after fiberoptic (FOB) tube position control.

Materials and methods. 10 patients (ASA I-II, 6 male, 4 female, undergoing major/minor abdominal surgery, no cases of predicted difficult intubation) after informed consent received the same anaesthesia protocol: preoxygenation in 100% oxygen followed by administration of propofol 2 mg^*kg^{-1}, fentanyl 1.5 μg^*kg^{-1} and cis-atracurium 0.2 mg^*kg^{-1}. A #5 AirQ was positioned with inflated cuff after 2 minutes and ventilation was checked (repositioning was performed if ineffective ventilation); a lubricated 8 mm ID endotracheal tube (ET) was then introduced through AirQ until a pre-signed mark corresponding to the ET tip completely out of AirQ airway conduit. FOB was then inserted into ET to assess position in front of the larynx. FOB was removed, blind intubation was attempted and checked with sidestream CO2. FOB-controlled position was graded as complete alignment (CA), partial alignment (PA) and missed alignment (MA) correspondingly to the relative position of ET tip in front of glottic opening. Insertion success, ventilation efficacy, intubation success, occurrence of desaturation or adverse events were recorded.

Results. Correct positioning was performed in 7/10 cases at first and in 10/10 at second attempt; ventilation was satisfactory in 6 patients, 9 after further cuff inflation or device manipulation. In one patient ventilation was ineffective because of air leak and gastric insufflation (intubation performed anyway). Alignment was CA=5 patients, PA=4 patients and MA=1 patient. Intubation was blindly performed at first attempt in 5 patients; after device and ET manipulation 4 patients were intubated during a second attempt while in a single case the patient was intubated by repositioning the FOB and railroading the ET into the glottic opening (partial alignment). No cases of desaturation were recorded.

Conclusions. AirQ performance results effective in terms of positioning and ventilation, thus locating this devices between safe alternatives for failed face-mask ventilation. Blind intubation success at first attempt was relatively low (50%), despite a quite high number of alignments between ET and glottic opening (50%+40%). Probably better results might be obtained after further training and with a longer learning curve, so further studies are needed to confirm safety and effectiveness of this new promising device.

Utility of the Intubating Laryngeal Airway®: Report of an Observational Study

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Introduction:

The Intubating Laryngeal Airway® (Cookgas Inc, St. Louis, MO) is a new FDA-approved device designed for airway management, or as a conduit for endotracheal intubation. We wished to characterize the utility of the ILA via a non-randomized observational study in a structured series of cases.

Methods:

The Intubating Laryngeal Airway (ILA) was used for airway management in 28 patients scheduled for gynecologic surgery. The ILA was used as a conduit for endotracheal intubation in 22 patients. A fiberoptic bronchoscope (FOB) was passed down the lumen of the ILA following placement to evaluate its relationship to airway structures in the first 20 patients, and to facilitate endotracheal intubation in select patients. Blind passage of an endotracheal tube (ETT) was attempted in 6 of the first 20 patients, and in all of the final 8 patients. In the latter group, the FOB was only used to diagnose obstruction to blind passage (thrice), or to complete failed blind intubation (once).

In 5 patients, extubation was performed under deep anesthesia with the ILA in situ.

All procedures were captured on videotape in the first 20 patients.

Results:

The Intubating Laryngeal Airway was successfully placed on the first attempt in 27/28 patients. A large leak during manual ventilation was corrected in 2 patients by slight withrawal of the device.

When the FOB was used, the glottis was visualized and the trachea intubated every time. Some degree of epiglottic intrusion was observed on fiberoptic examination in most cases. However, the keyhole-shaped aperture allowed a space for the epiglottis to intrude into, allowing unimpeded ventilation and fiberoptic access to the glottis.

Two cases of malpositioning of the ILA (inserted too deep and laterally displaced respectively), and one case of complete epiglottic downfolding, all without impedance to ventilation, were observed. Epiglotic downfolding was corrected by jaw lift and withdrawal of the ILA, followed by reinsertion (dubbed the "Klein Maneuver").

Under fiberoptic visualization (FOB within lumen of endotracheal tube with no manipulation), a regular endotracheal tube (Mallinckrodt Inc, St. Louis, MO cat. no. 86111) failed to pass directly into the trachea in 3 instances. The more flexible Mallinckrodt Reinforced Tracheal Tube (Mallinckrodt Inc, cat. no. 86552) was advanced directly into the trachea under unguided fiberoptic visualization in 2 of 2 instances. Blind passage of the Mallinckrodt Reinforced Tracheal Tube into the trachea without benefit of a FOB was successful in 8 of 11 instances. In the 8 cases of successful blind passage, 3 passed without jaw lift, and 2 passed following the application of jaw lift. 3 passed on the first attempt following the correction of obstructions to advancement (a downfolded epiglottis, too deep insertion, and lateral displacement of the ILA respectively).

Of the 5 patients extubated under deep anesthesia, the ILA required manipulation to establish airway control in 1 patient, and provided a controlled airway in 4 patients. All 5 patients emerged smoothly from anesthesia without bucking or straining.

Conclusion: The Intubating Laryngeal Airway is effective as a device for airway management, and as a conduit for endotracheal intubation. Optimal techniques for blind intubation, and the utility of the device in difficult airway scenarios, warrants further study.

Anesthesiology 2005; 103: A846

A Comparison of the Intubating Laryngeal Airway™ (ILA) with the Layrngeal Mask Airway™ (LMA)

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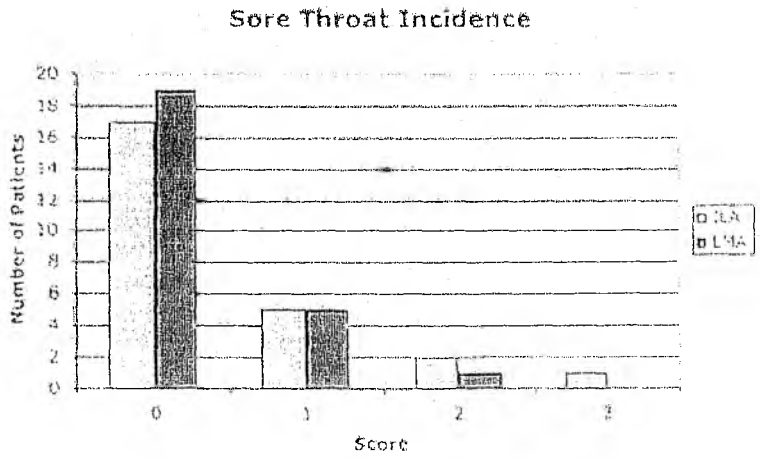
The Cookgas® Intubating Laryngeal Airway™(ILA) is a new supraglottic airway, and is designed for smoother insertion into the airway and to allow easier insertion of an endotracheal tube through the device. This study is designed to test if indeed the ILA provides smoother insertion into the airway. In this study, the ease of insertion by experienced anesthesiologists using the ILA was compared to ease of insertion by experienced anesthesiologists using the Laryngeal Mask Airway Classic™ (LMA). We hypothesize that ease of insertion is no different for either device. This was a prospective, randomized, controlled trial of healthy adult patients (ASA physical status I or II) undergoing general anesthesia for elective surgery. Patients with a history of reflux, hiatal hernia, morbid obesity (BMI > 40), previous upper gastrointestinal surgery, and taking proton pump inhibitors or H_2 antagonists were excluded. We measured supraglottic airway placement time, number of attempts to place the airway, and airway pressure at first audible leak after initial insertion and 5 min after the start of surgery. After surgery, the incidence and severity of sore throat was evaluated. A linear, mixed model analysis for repeated measures was used to compare airway pressures at initial insertion and at 5 min. The one-tailed test of equivalence was used to compare insertion times. The Wilcoxon rank-sum test was used to compare number of attempts to place the airway and occurrences of sore throat. The average ± SD placement time for the ILA and LMA was 20 ± 11 and 19 ± 8 seconds, respectively. There was no difference in placement time, number of attempts to place the airway, and sore throat (see figure) between the two devices. Overall there was no significant difference between the ILA and LMA in airway seal pressures, although, for the LMA, seal pressure significantly increased from 22.2 ± 4.9 cm H_2O just after placement to 24.5 ± 5.2 cm H_2O at 5 minutes after the start of surgery (P = 0.005). This finding warrants further study. We conclude that ease of insertion by experienced anesthesiologists is no different for the ILA compared to the LMA.[figure1]

Anesthesiology 2006; 105: A1283

Figure 1



Mercury Medical

1.0 Disposable
Air-Q Masked Laryngeal Airway

IMPORTANT REMINDER

Subject: Pediatric sized air-Q's Removal Procedure after Intubation

Date: July 17, 2009

The following procedures are currently in the air-Q *instructions for use*, this reminder notice is intended as a guideline. Many techniques can be successfully employed to ensure proper placement of the air-Q Masked Laryngeal Airway.

It is important to note that when removing the smaller sized disposable air-Q's (size 1.0, 1.5, 2.0) over an OETT tube that the pilot balloon may be too large to pass easily through the air-Q. If this should occur, simply deflate the pilot balloon and lightly lubricate it prior to withdrawing it.

Always check for adequate ventilation.

Example:

Some OETT tubes have a square or rectangle-shaped pilot balloon requiring them to be lubricated and folded before they will slip through the smaller sized air-Q's. Failure to lubricate could result in pulling off the pilot balloon or cause an accidental dislodgement of the OETT tube.

Garry Blount, Clinical Specialist

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CASE REPORTS/CASE SERIES

Lighted stylet-guided intubation via the intubating laryngeal airway in a patient with Hallermann-Streiff syndrome

L'intubation guidée avec un stylet lumineux via un masque laryngé d'intubation chez un patient souffrant du syndrome d'Hallermann-Streiff-François

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Abstract

Purpose *Hallermann-Streiff syndrome is a congenital syndrome associated with oculomandibulofacial abnormalities and potentially difficult airways. This case report describes the novel use of a lighted stylet-guided tracheal tube insertion through a new supraglottic airway, the intubating laryngeal airway (ILA™), in a patient with Hallermann-Streiff syndrome who had anticipated difficult airway.*

Clinical features *A 26-year-old male with Hallermann-Streiff syndrome was scheduled for a vitrectomy. The patient had mandibulofacial dystocia with a bird-like appearance, a mouth opening of 4 cm, a receding chin, and a Mallampati class 3 examination. The surgeon requested muscle paralysis and no movement during surgery. After receiving midazolam, fentanyl and propofol, a size 3.5 ILA™ was inserted and lung ventilation was easy to perform. A 7.5-mm internal diameter tracheal tube was mounted on a lighted stylet with its inner rigid stylet removed. After succinylcholine administration, the lighted stylet-tracheal tube assembly was inserted via the ILA™ until the transillumination just vanished below the sternal notch. The lighted stylet was removed, the circuit was connected, and capnography confirmed tracheal placement of tube. The ILA™ was deflated and left in situ. Upon emergence from anesthesia, the tracheal tube, and subsequently the ILA™, were removed without complications.*

Conclusions *This case presents a novel use of a lighted stylet-guided tracheal tube insertion through the ILA™ in a patient with Hallermann-Streiff syndrome. This intubation technique can be considered in patients with difficult airways as a primary route of intubation, or as a secondary rescue strategy.*

Résumé

Objectif *Le syndrome d'Hallermann-Streiff-François est un syndrome congénital associée à des anomalies oculo-mandibulo-faciales et des voies aériennes potentiellement difficiles. Cette présentation de cas décrit l'utilisation novatrice d'une sonde trachéale guidée par stylet lumineux pour l'intubation via un nouveau dispositif supraglottique de gestion des voies aériennes, le masque laryngé d'intubation ILA™, chez un patient souffrant du syndrome d'Hallermann-Streiff-François chez qui on prévoyait des voies aériennes difficiles.*

Éléments cliniques *Un homme de 26 ans souffrant du syndrome d'Hallermann-Streiff-François a été admis pour subir une vitrectomie. Le patient souffrait de dystocie mandibulo-faciale et présentait une apparence d'oiseau, une ouverture buccale de 4 cm, un menton effacé, et un score de Mallampati de classe 3. Le chirurgien a demandé que les muscles soient paralysés et qu'il n'y ait aucun mouvement pendant la chirurgie. Après l'administration de midazolam, de fentanyl et de propofol, un ILA™ de taille 3 a été inséré et la ventilation des poumons a été facile à réaliser. Une sonde trachéale de 7,5 mm de diamètre interne a été fixée à un stylet lumineux dont le stylet intérieur rigide avait été retiré. Après l'administration de*

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succinylcholine, le montage sonde trachéale – stylet lumineux a été inséré via le ILA™ jusqu'à ce que la diaphanoscopie disparaisse juste sous l'échancrure sternale. Le stylet lumineux a été enlevé, le circuit connecté, et la capnographie a confirmé le positionnement trachéal de la sonde. L'ILA™ a été dégonflé et laissé in situ. Lors du réveil de l'anesthésie, la sonde trachéale, puis l'ILA™, ont été extraits sans complications.

Conclusion *Ce cas présente une utilisation innovante de l'insertion d'une sonde trachéale guidée par stylet lumineux via un ILA™ chez un patient souffrant du syndrome d'Hallermann-Streiff-François. Cette technique d'intubation peut être envisagée pour les patients présentant des voies aériennes difficiles comme voie d'intubation principale, ou comme stratégie de sauvetage secondaire.*

Hallermann-Streiff syndrome is a congenital syndrome characterized by multiple maxillofacial anomalies, including microstomia, mandibular hypoplasia, dental anomalies, hypertichosis, difficult airway, and ophthalmologic abnormalities.[1–7] In consideration of the potential airway difficulties, the Intubating Laryngeal Airway by Cookgas®, LLC (ILA™, Mercury Medical, Clearwater, FL, USA) is a new supraglottic airway device with a functionality and insertion technique similar to that of an intubating laryngeal mask airway.[8,9] The lighted stylet has been used as an adjunct to guide the passage of a tracheal tube through an intubating laryngeal mask airway.[10,11] We describe the successful application of a lighted stylet-guided tracheal tube insertion through an ILA™ in a patient with Hallermann-Streiff syndrome and an anticipated difficult airway. Written consent for publication of the manuscript and the patient image was granted by the patient.

Case report

A 26-year-old male (32.7 kg, 165 cm) with Hallermann-Streiff syndrome was scheduled for a vitrectomy. He had undergone multiple surgical procedures under general anesthesia since childhood, and over the previous five years, he had undergone three eye surgeries performed under general anesthesia with laryngeal mask airways. The patient had a high school education and the mental capacity to provide consent for medical procedures.

He presented with mandibulofacial dystocia involving a bird-like appearance (Fig. 1). He had a 4 cm mouth opening, a receding chin, a normal temporomandibular joint, and a stable cervical spine. The Mallampati examination was class 3. The surgeon stated the critical nature of the retinal surgery and requested assurance of complete paralysis during the procedure. The planned procedure was to induce general anesthesia using short-acting anesthetic drugs and to insert an ILA™ followed by lighted stylet-guided tracheal intubation. If this method was unsuccessful, the back-up plan was fibreoptic bronchoscope-guided tracheal intubation.

Fig. 1 Lateral profile view of a patient with typical facial features seen in Hallermann-Streiff syndrome. Note the mandibulofacial dystocia with bird-like facies, parrot-beaked nose, small mouth opening, and receding chin

Standard monitoring included an electrocardiograph, a non-invasive blood pressure monitor, and a pulse oximeter. A 20G intravenous catheter was inserted. Anesthesia was induced with midazolam 1 mg *iv*, fentanyl 50 μg *iv*, and propofol 80 mg *iv*. A size 3.5 ILA™ (Fig. 2) was inserted in a manner similar to that for standard laryngeal mask airway insertion; then the cuff was inflated with 15 ml of air. Lung ventilation was verified by observation of chest wall movement and the presence of normal end-tidal carbon dioxide waveforms.

After successful ventilation using the ILA™, the patient received succinylcholine 60 mg *iv*. The following steps were taken to insert the tracheal tube. First, the rigid stylet was removed from the lighted stylet wand (Trachlight®, Laerdal Medical Corporation, Wappingers Falls, NY, USA; Fig. 3). Second, a conventional tracheal tube (7.5-mm internal diameter, Mallinckrodt Inc, Hazelwood, MO, USA) was mounted and clamped onto the lighted stylet in the usual manner.[12] Third, the lighted stylet-tracheal tube assembly was inserted through the ILA™. As the assembly was being advanced, a distinct dime-sized glow was observed in the anterior part of the patient's neck at the super-thyroid notch, the cricothyroid membrane, the

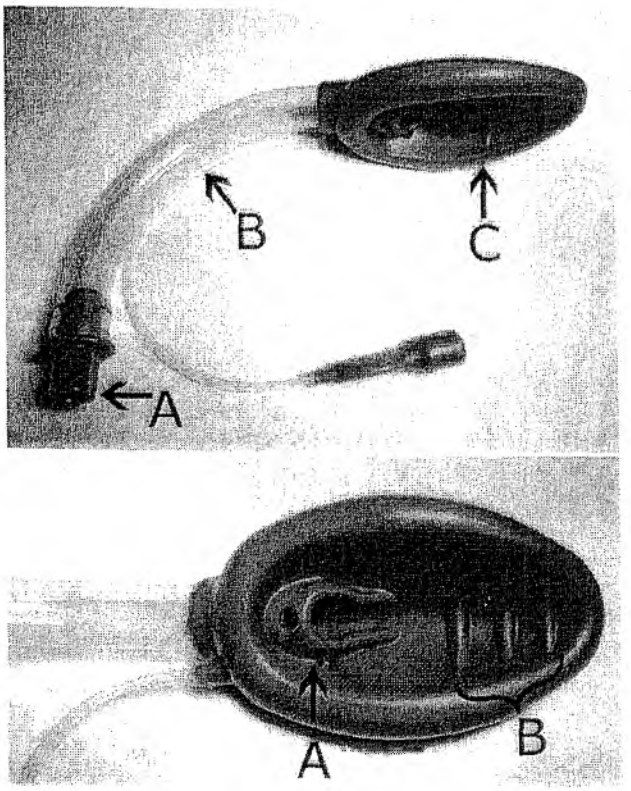

Fig. 2 (*Top*) Lateral view of the Intubating Laryngeal Airway (ILA™): (A) removable 15-mm connector; (B) transparent shaft; (C) inflatable silicone ILA™ bowl with a keyhole-shaped airway outlet and mask ridges. (*Bottom*) Anterior view of the ILA™ showing the inside of the ILA™ bowl: (A) keyhole-shaped airway outlet; (B) mask ridges

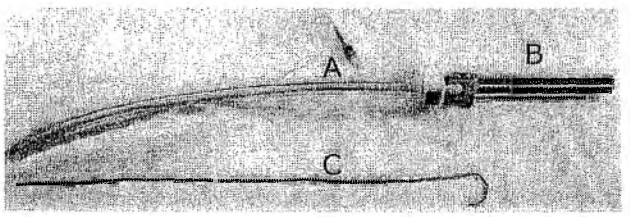

Fig. 3 Lateral view of a tracheal tube mounted on a lighted stylet wand with the rigid stylet removed: (A) conventional 7.5-mm tracheal tube; (B) lighted stylet wand; (C) rigid stylet

trachea, and, finally, the supra-sternal notch. The endotracheal tube was released from the lighted stylet clamp, and the lighted stylet was removed while the position of the tracheal tube was maintained. The tracheal tube cuff was inflated with 5 ml of air, and the correct tracheal tube position was confirmed by capnography. The ILA™ cuff was deflated and left in situ, and the tracheal tube was then taped and secured. The alternative was to remove the ILA™ while keeping the tracheal tube in position using a stabilizer, a technique similar to that using the intubating laryngeal mask airway. We elected to proceed with the former approach. Anesthesia was maintained with sevoflurane, oxygen, and air and progressed uneventfully.

At the end of the surgery, while the patient remained under inhalational anesthesia, both the endotracheal tube and the ILA™ were removed. A Cormack and Lehane grade 4 view was observed under direct laryngoscopy with a # 3 Macintosh blade. The ILA™ was reinserted and sevoflurane was discontinued. The patient awakened and the ILA™ was removed without complications.

Discussion

This case describes a novel application of a lighted stylet–guided tracheal tube insertion through an ILA™ in a patient with Hallermann-Streiff syndrome.

Hallermann-Streiff syndrome, also known as Hallerman–Streiff-Francois syndrome, Francois Dyscephalic syndrome, Oculomandibulofacial syndrome, or Oculo-Mandibulo-Dyscephaly-Hypotrichosis syndrome, was initially described by Aubry in 1893.[1] The characteristic features include dyscephaly, mental retardation, bird-like facies, a hypoplastic nose, microstomia, high arched palate, mandibular hypoplasia, anterior displacement of temporomandibular joint, an anterior larynx, and dental abnormalities, including natal malformed brittle teeth.[2,3] Multiple ophthalmological abnormalities have also been described.[3] Due to the abnormal anatomy of the upper airway, difficult airway management has been described.[2–6]

To date, several Hallermann-Streiff syndrome studies have suggested that the anesthesiologist use, or have available, alternative airway equipment for tracheal intubation.[3–6] The options for tracheal intubation include nasal intubation, oral intubation, and tracheostomy.[4–7] However, small nares, a hypoplastic nose, and a deviated nasal septum can make nasal intubation difficult.[3,4] In addition, a small mouth, displaced temporomandibular joint, hypoplastic mandible, and an anterior glottis may lead to difficult laryngoscopy and visualization.[3,4] If these difficulties are encountered, awake tracheostomy has been recommended; however, a short, thick neck has often been associated with the cricoid cartilage at the level of the suprasternal notch.[5,6]

Recent practice guidelines from the American Society of Anesthesiologists, the Difficult Airway Society, and the Canadian Airway Focus Group recommend the use of alternative airway devices, for instance, the intubating laryngeal mask airway, in the management of patients with anticipated and unanticipated difficult airways.[13–15] The use of a fibreoptic bronchoscope or a lighted stylet, in conjunction with an intubating laryngeal mask airway, has also been described.[10,11,16,17] There is a higher success rate and a decreased intubation time with lighted

stylet-guided intubation compared to blind intubation through an intubating laryngeal mask airway.[10,11] The ILA™, a new supraglottic airway device first introduced for North American clinical use in 2004, has been recommended as an alternative device for tracheal intubation.[9] Although the ILA™ and the laryngeal mask airway share functional similarities, there are a number of notable differences. Compared to the laryngeal mask airway, the ILA™ has a removable 15-mm circuit connector, no aperture bars at the ventilatory opening, and shorter shaft distances, thereby allowing insertion of larger diameter tracheal tubes.[9] Also, the ILA™ does not have a metal handle or a metal shaft; it is inserted like a standard laryngeal mask airway, and regular polyvinyl chloride tracheal tubes can be utilized.[18] This report describes successful lighted stylet-guided tracheal tube insertion through an ILA™ in a patient with Hallermann-Streiff syndrome.

There are several advantages to the presently described technique for tracheal intubation: (1) The ILA™ is relatively inexpensive; (2) there is familiarity with the insertion technique, due to similarities with the intubating laryngeal mask airway; (3) standard tracheal tubes can be used; (4) a flexible fibreoptic bronchoscope is not required; (5) ventilation can be maintained between intubating attempts; and (6) tracheal tube advancement guided by transillumination provides confirmation of intratracheal location, and positioning the tracheal tube tip at the suprasternal notch results in an approximate mid-tracheal location.[12] However, disadvantages do exist. (1) Anatomical features of Hallermann-Streiff syndrome, such as a small mouth, high-arched palate, mandibular hypoplasia, anterior displacement of temporomandibular joint, an anterior larynx, and dental abnormalities may prevent the use of supraglottic airways.[3,5,7] (2) Although lighted stylet-guided tracheal intubations through supraglottic devices are associated with a higher success rate, they are not universally successful. Thus, alternative techniques, including fibreoptic bronchoscopy, must be available. (3) The ILA™ is only available in sizes 2.5, 3.5, and 4.5; therefore, its use in smaller children and infants is limited. Just recently, a size 1.5 ILA™ became available for children weighing 10–20 kg.

In conclusion, patients with Hallermann-Streiff syndrome have multiple anatomical abnormalities and potentially difficult airways. We describe a novel application of a lighted stylet-guided tracheal tube insertion through an ILA™ in a patient with Hallermann-Streiff syndrome. This intubation technique can be considered as a primary route of intubation in patients with difficult airways or as a secondary rescue strategy if a primary method fails. Further studies are needed to assess the effectiveness of ILA™-guided intubation with fibreoptic bronchoscopy.

Acknowledgement This study was supported by the Department of Anesthesia, Toronto Western Hospital, University of Toronto.

Conflicts of interest None declared.

References

1. *Aubry M.* Variete singuliere d'alopecie congenitale. Alopecie suturale. Ann Dermatol Syph 1893; 4: 899–900.
2. *Francois J.* A new syndrome: dyscephalia with bird face and dental anomalies, nanism, hypotrichosis, cutaneous atrophy, microphthalmia and congenital cataract. AMA Arch Ophtalmol 1958; 60: 842–62.
3. *Bissonnette B.* Syndromes A to Z. In: Bissonnette B, Luginbuehl I, Marciniak B, Dalens B, editors. Syndromes: Rapid Recognition and Perioperative Implications. New York: McGraw-Hill; 2006; p. 357–8.
4. *Ravindran R, Stoops CM.* Anesthetic management of a patient with Hallermann-Streiff syndrome. Anesth Analg 1979; 58: 254–5.
5. *Malde AD, Jagtap SR, Pantvaidya SH.* Hallermann-Streiff syndrome: airway problems during anaesthesia. J Postgrad Med 1994; 40: 216–8.
6. *Sataloff RT, Roberts BR.* Airway management in Hallermann-Streiff syndrome. Am J Otolaryngol 1984; 5: 64–7.
7. *Cheong KF, Tham SL.* Anaesthetic management of a child with Hallermann-Streiff Francois syndrome. Paediatr Anaesth 2003; 13: 274–5.
8. *Klein MT, Jones J.* Utility of the Intubating Laryngeal Airway®: report of an observational study. Anesthesiology 2005; 103: A846 (abstract).
9. *Wong DT, McGuire GP.* Endotracheal intubation through a laryngeal mask/supraglottic airway. Can J Anesth 2007; 54: 489–91.
10. *Fan KH, Hung OR, Agro F.* A comparative study of tracheal intubation using an intubating laryngeal mask (Fastrach) alone or together with a lightwand (Trachlight). J Clin Anesth 2000; 12: 581–5.
11. *Chan PL, Lee TW, Lam KK, Chan WS.* Intubation through intubating laryngeal mask with and without a lightwand: a randomized comparison. Anaesth Intensive Care 2001; 29: 255–9.
12. *Stewart RD, LaRosee A, Kaplan RM, Ilkhanipour K.* Correct positioning of an endotracheal tube using a flexible lighted stylet. Crit Care Med 1990; 18: 97–9.
13. *American Society of Anesthesiologists Task Force on Management of the Difficult Airway.* Practice guidelines for management of the difficult airway and updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2003; 98: 1269–77.
14. *Henderson JJ, Popat MT, Latto IP, Pearce AC; Difficult Airway Society.* Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004; 59: 675–94.
15. *Crosby ET, Cooper RM, Douglas MJ, et al.* The unanticipated difficult airway with recommendations for management. Can J Anaesth 1998; 45: 757–76.
16. *Joo HS, Rose DK.* The intubating laryngeal mask airway with and without fiberoptic guidance. Anesth Analg 1999; 88: 662–6.
17. *Joo HS, Kapoor S, Rose DK, Naik VN.* The intubating laryngeal mask airway after induction of general anesthesia versus awake fiberoptic intubation in patients with difficult airways. Anesth Analg 2001; 92: 1342–6.
18. *Wong DT, Arora G, Apichatibutra N, Lee VY, Venkatraghavan L.* Repeated performance of tracheal tube insertion through intubating laryngeal airway on mannequins. Anesthesiology 2008; 106: A1175 (abstract).

Males			Females		
Height	Ideal weight in pounds	Ideal weight in kilograms	Height	Ideal weight	Ideal weight in kilograms
4' 6"	63 - 77	29 - 35	4' 6"	63 - 77	29 - 35
4' 7"	68 - 84	31 - 38	4' 7"	68 - 83	31 - 38
4' 8"	74 - 90	34 - 41	4' 8"	72 - 88	33 - 40
4' 9"	79 - 97	36 - 44	4' 9"	77 - 94	35 - 43
4' 10"	85 - 103	39 - 47	4' 10"	81 - 99	37 - 45
4' 11"	90 - 110	41 - 50	4' 11"	86 - 105	39 - 48
5' 0"	95 - 117	43 - 53	5' 0"	90 - 110	41 - 50
5' 1"	101 - 123	46 - 56	5' 1"	95 - 116	43 - 53
5' 2"	106 - 130	48 - 59	5' 2"	99 - 121	45 - 55
5' 3"	112 - 136	51 - 62	5' 3"	104 - 127	47 - 58
5' 4"	117 - 143	53 - 65	5' 4"	108 - 132	49 - 60
5' 5"	122 - 150	55 - 68	5' 5"	113 - 138	51 - 63
5' 6"	128 - 156	58 - 71	5' 6"	117 - 143	53 - 65
5' 7"	133 - 163	60 - 74	5' 7"	122 - 149	55 - 68
5' 8"	139 - 169	63 - 77	5' 8"	126 - 154	57 - 70
5' 9"	144 - 176	65 - 80	5' 9"	131 - 160	60 - 73
5' 10"	149 - 183	68 - 83	5' 10"	135 - 165	61 - 75
5' 11"	155 - 189	70 - 86	5' 11"	140 - 171	64 - 78
6' 0"	160 - 196	73 - 89	6' 0"	144 - 176	65 - 80
6' 1"	166 - 202	75 - 92	6' 1"	149 - 182	68 - 83
6' 2"	171 - 209	78 - 95	6' 2"	153 - 187	70 - 85
6' 3"	176 - 216	80 - 98	6' 3"	158 - 193	72 - 88

6' 4"	182 - 222	83 - 101	6' 4"	162 - 198	74 - 90
6' 5"	187 - 229	85 104	6' 5"	167 - 204	76 - 93
6' 6"	193 - 235	88 - 107	6' 6"	171 - 209	78 - 95
6' 7"	198 - 242	90 - 110	6' 7"	176 - 215	80 - 98
6' 8"	203 - 249	92 - 113	6' 8"	180 - 220	82 - 100
6' 9"	209 - 255	95 - 116	6' 9"	185 - 226	84 - 103
6' 10"	214 - 262	97 - 119	6' 10"	189 - 231	86 - 105
6' 11"	220 - 268	100 - 122	6' 11"	194 - 237	88 - 108

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2. The doctor says the air–Q did not make a seal. More than likely the doctor put too much air in the cuff. This is a very common mistake with the smaller sizes of air-Q. **Leaving behind the "Quick Tips" Reference Guide, along with reminding the doctor that less air in the air–Q will create a better seal, will usually eliminate this problem. A nice bounce on the pilot balloon is best. Don't forget to remind the clinician that the air–Q works best after 1 to 2 minutes in the patient's airway.**

3. The doctor does not use proper lubrication and attempts to insert the air-Q dry. **Corrective action is to lubricate the back of the air–Q and the front ridges of the mask cavity**. Sometimes the tongue is very dry and can be pushed back during insertion, blocking the airway passage.

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References

1 Wong DT, Woo JA, Arora G. Lighted stylet-guided intubation via the intubating laryngeal airway in a patient with Hallermann–Streiff syndrome. *Can J Anaesth* 2009; **56**: 147–150.
2 Jagannathan N, Roth A, Sohn L *et al.* The new air-Q intubating laryngeal airway for tracheal intubation in children with anticipated difficult airway: a case series. *Pediatr Anesth* 2009; **19**: 618–622.
3 Hung OR, Pytka S, Morris I *et al.* Clinical trial of a new lightwand device (Trachlight) to intubate the trachea. *Anesthesiology* 1995; **83**: 509–514.

Intubation via the intubating laryngeal airway in two pediatric patients with predicted difficult airways

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SIR—We read with interest the case series by Jagannathan *et al.* (1) employing the AirQ® intubating laryngeal airway (ILA; Mercury Medical, Clearwater, Florida, USA), a novel LMA device, and the follow-up correspondence it engendered (2). By way of contribution to this debate, we report the successful use of the ILA in two pediatric patients with a predicted difficult airway and discuss solutions to some practical problems we have encountered in our early experiences with this device.

Case report 1

An 11 year-old, 28 kg boy required emergent insertion of a hemodialysis catheter for the treatment of acute renal and liver failure. The origin of his acute condition was not entirely clear but was possibly attributable to analgesic-induced nephropathy and hepatotoxicity, superimposed on a dehydrated state. His medical history was remarkable for type II spinal muscular atrophy. He had an 88° scoliosis. Recent pulmonary function tests had yielded a forced vital capacity of 34% of predicted. Polysomnography in 2008 revealed no nocturnal desaturations and no upper airway obstruction. Under general anesthesia for dental extractions in 2005, conventional laryngoscopy had yielded a grade 4 Cormack and Lehane view. He was easy to hand ventilate. At that time, he was intubated fiberoptically through a size three LMA.

On examination, respiratory rate was 29 breaths per minute, sitting upright in bed. Arterial oxygen saturation was 97% on 8 $l \cdot min^{-1}$ face mask oxygen. No arterial blood gases were available. He was hemodynamically stable. He had micrognathia and prominent upper incisors with normal mouth opening. He had no fixed neck deformity, and the range of movement was normal when assisted for his muscular weakness. On auscultation of his chest, he had bilateral crepitations and upper airway secretions. The abdomen was tensely distended because of ascites. He had a double lumen right internal jugular line *in situ*.

Preoperative investigations revealed an international normalised ratio (INR) of 3.1 and an activated partial thromboplastin time (aPTT) of 34.1 s. Transaminases were elevated beyond 4000 $U \cdot l^{-1}$. Fresh-frozen plasma was available for intraoperative transfusion. Electrolytes were within normal limits.

In light of his impending respiratory failure, known grade 4 view, and significant coagulopathy, we planned a fiberoptic intubation through an AirQ® ILA, recognizing that this would allow us to oxygenate and ventilate in between intubation attempts if needed. We also had a size 2.5 ProSeal™ LMA available. After preoxygenation and stable induction (glycopyrrolate 100 μg; ketamine 15 mg; propofol 100 mg) and following confirmation of easy bag-mask ventilation, we injected remifentanil 50 μg and easily inserted a size 2.5 ILA. Manual ventilation was easy, with a good seal to a peak inspiratory pressure of 25 cm H_2O. A silicone spray-lubricated 3.8 -mm fiberoptic bronchoscope (FOB), preloaded with a lubricated 5.5 cuffed oral endotracheal tube (ETT), was inserted into the lubricated lumen of the ILA after removing the ILA's detachable 15 -mm circuit connector. The larynx was easily visualized as the FOB exited the ILA and was advanced into the trachea. However, we met with resistance as we slid the ETT over the FOB and through the ILA. Assuming the holdup to be at the glottis, we down-sized the ETT to a size 5.0 cuffed ETT. The same problem was encountered. This time, we withdrew the ILA, with the ETT and FOB held in place within its lumen. We found that the ETT was held up at the exit of the ILA. With ETT rotation, we were able to advance the ETT through the ILA outlet and thence over the FOB into the trachea in a conventional manner. The patient remained well oxygenated throughout the intubation. The ILA was withdrawn over the ETT without difficulty.

Case report 2

A 12 -month-old, 6.8 -kg girl with peripheral arthrogryposis presented for surgical correction of club foot. The

infant's medical history was unremarkable. She had undergone uneventful anesthesia 3 weeks earlier for a CT scan, but she had never been intubated and her laryngoscopic view was unknown. On examination prior to this anesthetic, we noted a small mandible and oral aperture.

We induced anesthesia with sevoflurane in oxygen then obtained i.v. access. After confirming ease of bag-mask ventilation, we administered propofol 5 $mg \cdot kg^{-1}$, remifentanil 3 $mg \cdot kg^{-1}$, and rocuronium 0.8 $mg \cdot kg^{-1}$. Direct laryngoscopy with a Robershaw 1 blade yielded a grade 3 view. We inserted a size 1 ILA and intubated the child with a cuffed 3.5 -mm ETT over a 2.8 -mm FOB, using the ILA as a conduit. Ventilation was easy via the ILA, and an excellent view of the larynx was appreciated on passing the FOB through the ILA. The ETT passed easily into the larynx. The ILA was removed over the ETT, which was extended in length by using the customized disposable stylet specifically designed for this purpose (Figure 1). We only had a size 0 stylet available (the smallest size, 00, is now available), and the tapered distal end that is supposed to fit into the ETT was too large. By inverting the stylet and inserting the 'wrong' end into the endotracheal tube, we were able to overcome this problem and remove the ILA while retaining full control of the ETT. The pilot balloon, however, did not fit through the ILA, so it was cut off and replaced after ILA removal with a 24G (Becton Dickinson, Sandy, Utah) i.v. cannula, stopcock, and syringe assembly.

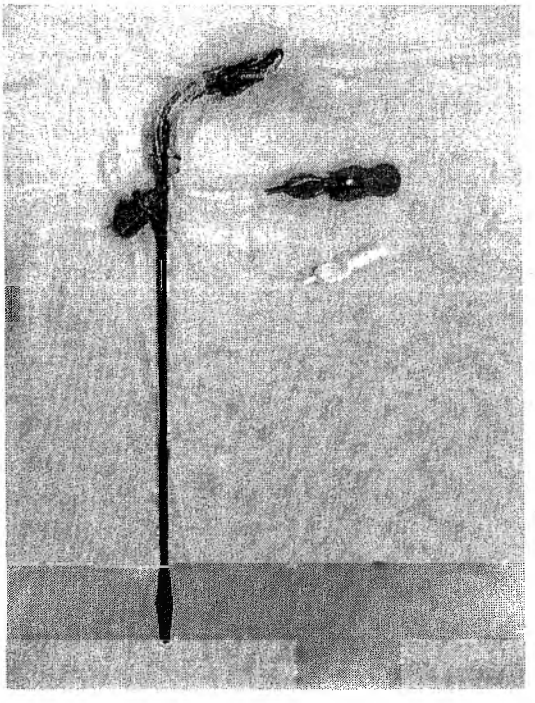

Figure 1
Size 0 stylet inserted 'wrong way round' into proximal end of 3.5 mm endotracheal tube to allow retention of control of ETT position during AirQ® intubating laryngeal airway removal.

Discussion

A patient with a known difficult intubation in the setting of respiratory failure requires a technique that will allow rapid reliable re-oxygenation during attempts at intubation. In addition, severe coagulopathy is a contraindication for nasal intubation. Hence, our first patient was ideally suited for a supraglottic device-assisted technique. The AirQ® ILA is specifically designed for this purpose, and pediatric sizes have been introduced recently.

At the time of our first case, the ILA was only available in two pediatric sizes: 1.5 and 2.5. Very recently, two smaller sizes of ILA have become available, the numbering of the sizes has been altered, and the weight range recommendations have changed (2). As with all airway devices, recommended weight ranges are only guides, and clinical judgment is required in each case to determine the best size for each individual patient. In our case, the size 2.5 device gave a good airway seal at pressures that allowed easy positive pressure ventilation.

The stylet (Figure 1) helps to overcome a problem particular to pediatrics, where the ETT can be contained entirely within the shaft of an LMA. The stylet effectively lengthens the ETT to sufficiently allow continuous retention of control of the ETT throughout withdrawal of the ILA over the ETT, which is helpful in reducing the risk of accidental extubation. In their series of case vignettes (1), Jagannathan *et al.* reported that the ILA can be withdrawn over the ETT without extending the ETT, because of the short, hyper-curved morphology of the ILA. While we agree that this is technically feasible, it is awkward and does not seem particularly safe in a difficult airway situation, when an easily employed, likely safer alternative is available.

Tube hold-up at the ILA exit caused some difficulty in the first case. This problem can be encountered when using any supraglottic airway device as a conduit for intubation. The manufacturer's recommendation is to lubricate the outer surface of the ETT and slide it in and out of the ILA tube several times to lubricate the inner passage of the ILA. In retrospect, we believe that we did not adequately lubricate the lumen of the ILA airway. With better lubrication, we have not had this problem during subsequent intubations through the device.

By contrast, we encountered no difficulty passing the 3.5 cuffed endotracheal tube past the distal aperture of the size 1 ILA in the second case. The only problem we encountered in this case was an inability to pass the pilot balloon through the ILA lumen. This was handled by cutting off the pilot balloon. Using a 4.0 uncuffed endotracheal tube would have obviated this problem.

The technique of inverting a stylet designed for a larger ETT worked very well in this case, but we do not routinely recommend it because of the theoretical risk of having the end of the stylet advance too far into the endotracheal tube such that it becomes difficult to remove.

In summary, we have used a novel supraglottic airway device, the AirQ® ILA, as a conduit for fiberoptic intubation in two difficult intubation scenarios. We are currently evaluating its use in pediatric patients, both as a primary supraglottic airway and as a conduit for intubation.

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References

1 Jagannathan N, Roth AG, Sohn LE *et al.* The new air-Q intubating laryngeal airway for tracheal intubation in children with anticipated difficult airway: a case series. *Pediatr Anesth* 2009; **19**(6): 618–622.
2 Parotto M, Micaglio M, Armellin G *et al.* The new air-Q intubating laryngeal airway for tracheal intubation in children with anticipated difficult airway: comment. *Pediatr Anesth* 2009; **19**(10): 1028–1029; author reply 1029–30.

Successful intubation of a child with Goldenhar syndrome, who previously failed intubation, using an Airtraq

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SIR—A 9-year-old female, 40 kg, with no allergies, on no medication, and with hearing loss was scheduled for first stage right microtia repair. The child was born with Goldenhar syndrome (Oculoauricular Dysplasia) (Figure 1). She had incomplete development of both ears, nose and right hemi-micrognathia. She had previous surgery to enlarge the right side of her mandible using a bone graft. At that time, an elective preoperative tracheostomy was performed for perioperative airway management. After recovery, the tracheostomy stoma was allowed to close.

On examination, the right half of the mandible was still smaller than the left, and her face was deviated to the right. The child had limited movement at neck extension. The trachea was palpable; however, it was deviated to the right. The thyromental distance was three finger breadths.

Funding was provided by the Department of Anesthesiology, The University of Texas Medical School with work performed at Memorial Hermann Hospital, Houston, TX, USA.

Figure 1
Child with Goldenhar Syndrome.

The inter-incisor distance was 3.5 ml and had Mallampati Class IV. The airway was deviated to the right. The child had a history of snoring; however, her sleep study results were normal. Difficult airway management was anticipated. A difficult airway cart including a fibroscope and a pediatric glidescope was at hand.

The child was scheduled for the michrocia repair 1 week earlier at our institution and had failed intubation. At that time, general anesthesia was induced via mask using sevoflurane in oxygen, and there was no difficulty in mask ventilation. An i.v. line was placed; fentanyl, 100 μg i.v. and propofol, 100 mg i.v. were administered. Several trials to intubate the child's trachea using Macintosh and Miller blades by both the resident and the pediatric anesthesiologist were failed. The child started to bleed from the mouth, and the surgeon requested to wake up the child and postpone the surgery.

On the day we saw the child, after preparing the OR to manage a difficult airway, the anxious child was premedicated with versed P.O. After placing routine monitors, anesthesia was induced using sevoflurane in oxygen via a mask. An i.v. catheter was then placed. Fentanyl, 50 μg i.v. and propofol, 130 mg i.v. were administered. Using a child's Airtraq optical laryngoscope (Prodol Meditec, Vizcaya, Spain), size 11, we were able to clearly see the glottis, the vocal cords and the passage of the cuff of the endotracheal tube beyond the vocal cords. Proper placement of the endotracheal tube was verified by bilateral chest rise, auscultation and presence of end-tidal CO_2. We were able to place the cuffed orotracheal tube, size 5.5, on the first attempt, without difficulty and in a very short time.

The Airtraq laryngoscope is a new single-use device for orotracheal or nasotracheal intubation, an optic device and an anatomically curved blade that guide the tracheal tube in a lateral channel.

British Columbia's Children's Hospital

PROTOCOL

TITLE: EVALUATION OF THE INTUBATING LARYNGEAL AIRWAY IN CHILDREN

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I. BACKGROUND

The laryngeal mask airway (LMA) was introduced in 1986 & can truly be said to have revolutionised airway management in anaesthesia. The LMA is now extensively employed as a device for maintaining airway patency under anaesthesia. It is an extraglottic device, meaning that it does not pass through the vocal cords. In addition to its routine use as a primary airway during elective anaesthesia, it has found a role in airway management in the emergency room, and in resuscitation (both in-hospital and out-of-hospital). It is also used as a rescue device in management of the difficult airway.

As the advantages and versatility of the original (Classic) LMA (CLMA) became apparent, various modifications in its design evolved, to improve certain shortcomings. The ProSeal LMA (PLMA) has improved pharyngeal seal, whilst the Intubating LMA (ILMA) offers a bespoke solution to securing the airway with an endotracheal tube via the LMA. The drive towards disposable equipment has led to the availability of a parallel family of single use LMA devices & the expiry of patents has allowed multiple manufacturers to produce their generic versions of both re-usable & disposable LMAs.

Throughout this 20-year evolution, two issues have remained constant. The first is that the LMA options for paediatric patients undergoing anaesthesia have been restricted by differences in size & 3-dimensional pharyngeal anatomy. CLMAs are available in paediatric sizes, but do not perform as well or as reliably as in adults [refs]. PLMAs are also available, except in the smallest size, & have been shown to perform superiorly to CLMAs with respect to sealing pressures [refs]. The ILMA is a much bulkier device & is not available in paediatric sizes. Thus the LMA options for airway rescue in the difficult paediatric airway are more limited. The second is that the performance, reliability & usability of each and every iteration or modification of the LMA need to be comprehensively evaluated. The methodology for such evaluation is well described. However, because of the lower profile of the LMA in difficult airway management in children, the evaluation of LMAs for this purpose in this population is a neglected research area.

The intubating laryngeal airway (ILA) is a new extraglottic device specifically engineered for use both as a standalone laryngeal mask airway (LMA) and as a rescue device or "Plan B" device in the event of a difficult airway. As with some other types of LMA, it is then possible to insert an endotracheal tube (ETT) through the ILA, either blindly or mounted on a fibreoptic bronchoscope (FOB), to achieve endotracheal intubation. The novel features of the ILA are:

1. The proximal 15 mm connector is removable.
2. The cross-sectional profile of the airway is elliptical, rather than circular, which reportedly makes make ETT pilot balloon passage easier.
3. The shape & orientation of the distal outlet from the ILA aim to direct a FOB &/or an ETT reliably towards the glottis.
4. The device comes with an optional stylet that is designed to screw into the proximal end of an ETT that has been inserted through the ILA. This facilitates retention of control of the ETT at all

times during removal of the ILA over the ETT & stylet, thus reducing the risk of dislodging the ETT & "losing" the airway.

5. A number of "anatomical" features of the mask which conspire to improve the "fit" & seal of the mask once *in situ*.

The ILA is currently available in four paediatric sizes, viz. 1.0, 1.5, 2.0 & 2.5. Table 1 indicates the recommended weight range for each size, along with the maximum endotracheal tube size that can pass through that size. The sizing convention is the same as for CLMAs & PLMAs & recommended weight guidelines are identical for the three types of LMA.

Table 1: ILA characteristics by size.

ILA size	Weight range (kg)	Approx age (yr)	Max. ETT ID (mm)
1.0	<5	0-0.5	4.5 (uncuffed)
1.5	5-10	0.5-1	5.0 (uncuffed)
2.0	10-20	1-5	5.5 (cuffed)
2.5	20-50	5-12	6.5 (cuffed)

Objectives & Hypotheses:

The objectives of this 3-phase study are:

i) to test the performance characteristics of the ILA as a primary airway in clinical paediatric anaesthetic practice;

ii) to compare its performance to the current best option, which is the PLMA for sizes 1.5, 2.0 & 2.5, & the CLMA for size 1.0;

iii) to evaluate the performance characteristics of the ILA as a conduit for fibreoptic intubation.

Progression will be subject to satisfactory results from the preceding study phase.

Hypotheses:

Phase 1.

This will be a prospective observational study of the ILA's performance, measured by multiple indicators as detailed in the methods section. It is not a comparative study & there is no testable hypothesis. Data collected will be used to refine the sample sizes in Phase 2.

Phase 2.

1. H_0: Mean oropharyngeal leak pressure with size 2.5 ILA = mean oropharyngeal leak pressure with size 2.5 PLMA.

   H_1: Mean oropharyngeal leak pressure with size 2.5 ILA ≠ mean oropharyngeal leak pressure with size 2.5 PLMA.

2. H_0: Mean oropharyngeal leak pressure with size 2.0 ILA = mean oropharyngeal leak pressure with size 2.0 PLMA.

   H_1: Mean oropharyngeal leak pressure with size 2.0 ILA ≠ mean oropharyngeal leak pressure with size 2.0 PLMA.

3. H_0: Mean oropharyngeal leak pressure with size 1.5 ILA = mean oropharyngeal leak pressure with size 1.5 PLMA.

   H_1: Mean oropharyngeal leak pressure with size 1.5 ILA ≠ mean oropharyngeal leak pressure with size 1.5 PLMA.

4. H_0: Mean oropharyngeal leak pressure with size 1.0 ILA = mean oropharyngeal leak pressure with size 1.0 CLMA.

   H_1: Mean oropharyngeal leak pressure with size 1.0 ILA ≠ mean oropharyngeal leak pressure with size 1.0 CLMA.

Phase 3.

This will be a prospective observational study of the usability of the ILA as a conduit for fibreoptic intubation, as might be conducted during airway rescue in the event of a failed intubation. It is not a comparative study & there is no testable hypothesis.

II. EXPERIMENTAL DESIGN

Research design

Phase 1. Prospective observational study of ILA performance as the primary airway, stratified by ILA size.

Phase 2. Prospective comparison of ILA vs. PLMA (sizes 1.5, 2.0 & 2.5) and of ILA vs. CLMA (size 1).

Phase 3. Prospective observational study of ILA performance as a conduit for fibreoptic intubation, stratified by ILA size.

Basic demographic data / subjects:

Table 2: Anticpated group sizes by phase of study

	ILA size 1.0	ILA size 1.5	ILA size 2	ILA size 2.5
Phase 1	30	30	30	30
Phase 2*	40	40	40	40
Phase 3	30	30	30	30

* For the purpose of calculating sample sizes, we will take leak pressure, P_{leak} as the primary outcome variable of interest. Using published data for mean leak pressures with PLMA vs CLMA, detecting a clinically relevant change of 20% in either direction, with $\alpha = 0.05$ and power of 80% requires group sizes of 36; 26; 33 for sizes 1.5 – 2.5 respectively. As there is no size 1.0 PLMA, there has been no comparative study with the size 1.0 CLMA to inform a power calculation. Empirically one would expect the mean leak pressure for the size 1.0 CLMA to be

lower than for any other size; assuming standard deviation to be proportionately similar, a pilot sample of 40 patients per group should be large enough to detect a 20% difference in P_{leak}. These group sizes will be refined based on data from phase 1.

Phases 1 & 2:

ASA I-III

Non-emergent surgery

Considered safe & suitable for airway management by LMA.

Phase 3:

ASA I-III

Non-emergent surgery

Considered to require endotracheal intubation for airway management.

Exclusion criteria

Phases I , II & III:

ASA status IV-V

Contraindication to LMA placement

Aspiration risk

Clinically significant pulmonary disease

Coagulopathy

Distorted airway anatomy judged likely to compromise LMA placement

Emergent surgery

Prone positioning (phases I-II only)

Methods

Recruitment of subjects: With ethical and institutional review board approval, and with written parental consent (and patient assent as appropriate), we will invite children who meet the inclusion criteria to take part in this study whilst undergoing surgery at BC Children's Hospital.

Phase 1Eligible children will receive anaesthetic management from one of the staff anesthesiologists listed as study investigators. The technique of induction of anaesthesia will either be intravenous (propofol 5 mg/kg and remifentanil 2.5 mg/kg), or inhalational (sevoflurane 5-8% in O_2/air), to be decided by the staff anesthesiologist. Routine anesthetic monitoring will be applied. After induction of anaesthesia, the anesthesiologist will insert the appropriate-sized ILA & inflate the cuff to an intracuff pressure of 60 cm H_2O. Intracuff pressure will be measured with a digital pressure cuff monitor. With the head in a neutral position, the anaesthesiologist will then formally evaluate the airway as follows:

i) Attempts at ILA placement. Two attempts to position the device satisfactorily are clinically acceptable. Failed LMA insertion is defined as requiring >2 attempts.

ii) Ease of insertion. Subjective evaluation by the anesthesiologist, based on career experience, rated as a score from 0-10, with 0 being "the easiest possible insertion" and 10 being "the most difficult insertion ever".

iii) Quality of airway patency. With the breathing circuit's adjustable pressure limiting (APL) valve set at 20 cm H_2O, the patient's lungs are manually ventilated. Allowed assessments are:

   a. Excellent - defined as chest rise with no audible leak.

   b. Adequate - defined as chest rise despite an audible leak.

   c. Poor - defined as absent or inadequate chest rise with audible leak.

iv) Gastric insufflation. Measured by auscultation as present or absent.

v) Maximum tidal volume (V_T max). With an intracuff pressure of 60 cm H_2O & the APL valve at 20 cm H_2O, the lungs are manually ventilated by squeezing the bag until gas leaks. The volume of the exhaled breath delivered is measured on the anaesthetic machine. The best of 3 such breaths is recorded as V_T max.

vi) Oropharyngeal leak pressure (OLP). The APL valve is closed & the pressure at which an oropharyngeal leak develops is recorded. If no leak develops before the circuit pressure reaches 40 cm H_2O, the APL valve will be opened & this event recorded.

vii) The assessments of VT max. & OLP are repeated with the head in the following positions:

a. Maximum flexion

b. Maximum extension

c. Maximum left rotation

d. Maximum right rotation

viii) Fibreoptic view. With head restored to neutral position, flexible fibreoptic laryngoscopy will be performed through a swivel adaptor (to allow continuous ventilation of the lungs to continue). The tip of the fibreoptic bronchoscope will be positioned at the distal outlet of the ILA. The view of the larynx is scored as follows [ref]:

1. No vocal cords are seen
2. The vocal cords & anterior (downfolded) epiglottis are seen
3. The vocal cords & posterior epiglottis are seen
4. The vocal cords only are seen

During the surgical procedure, any necessary adjustments to the ILA, problems with ventilation or adverse airway events will be documented. In every study case, an alternative LMA device (CLMA or PLMA) will be immediately available in the unlikely event that the anesthesiologist decides to abandon use of the ILA. In addition, & as is currently standard practice when any LMA technique is

used, age- & size-appropriate laryngoscopes, endotracheal tubes & emergency airway drugs will be immediately available. With the exception of the fibreoptic view scoring, the evaluation described is a protocolised, formal version of the routine assessment that every anesthesiologist makes of any LMA device during everyday clinical practice. It should be noted that the formal assessment can be done during surgical preparation time & will not delay the start of surgery, nor prolong the duration of anesthesia.

At the end of the anaesthetic, the ILA will be removed & inspected for blood staining (an indicator of traumatic insertion).

Recovery nursing staff will enquire about & document the occurrence of sore throat post-operatively in children who are old enough to understand the question.

Data will be presented as mean ± SD, percentages or proportions as appropriate. The data on OPL will be used to refine the sample sizes for phase 2.

Phase 2

Eligible children will undergo induction of anesthesia as described in phase 1. In each child in groups 1.5, 2.0 & 2.5, either a PLMA or an ILA will be inserted & the evaluation described in phase 1 will be conducted. In group 1.0, either a CLMA or an ILA will be inserted & evaluated. The first LMA will then be removed & the other device inserted & assessed. The order in which the LMA devices are inserted will be determined by randomisation after recruitment & before induction of anesthesia. The primary outcome measure will be the OPL value. In previous studies comparing different LMAs, these data have been normally distributed, therefore we anticipate conducting inferential statistical analysis using paired t- tests. We will conduct appropriate statistical analysis of the data on the other assessment variables, which are all secondary outcome measures.

Phase 3

Outcome measures

Dissemination

Oral presentation at an international meeting.

Publication in a core anaesthetic journal.

Justification for any funding requested

Study period

References

Highlights:

- The Pediatric Difficult Airway abstract, **Managing the Difficult Airway in Children . . .** specifically lists pediatric air-Q® as a successful intubation device for difficult pediatric airways when standard direct laryngoscopy fails.

- **Fiberoptic-Guided Tracheal Tube Placement through the air-Q ILA: Performance Study in a Manikin**

  "We conclude that FOB-guided TT insertion via the **air-Q** ILA shows promise as a highly successful and rapid technique for tracheal intubation, particularly in a "rescue" situation where a supraglottic airway device is required."

- **Three Methods of Fiberoptic-Guided Tracheal Intubation Via air-Q® ILA and LMA-Classic™ in a Manikin**

  The **air-Q®** Intubating Laryngeal Airway (ILA, Mercury Medical, Clearwater, FL) is a newer supraglottic airway intended for use as a primary airway or a conduit for tracheal tube (TT) placement. TT placement via the ILA may simplify tracheal intubation in a "rescue" situation where a supraglottic airway device is required.

  Our study is the first to compare three techniques of FOBG TT placement via the ILA and cLMA. The results demonstrate comparably high success rates between the three techniques with **shorter times for the ILA** and AIC versus the AECS **and user preference for the ILA**.

A250
October 16, 2010
2:00:00 PM - 4:00:00 PM
Room Hall B1-Area J

Fiberoptic-Guided Tracheal Tube Placement through the air-Q® ILA: Performance Study in a Manikin

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Introduction

The **air-Q®** Intubating Laryngeal Airway (ILA, Mercury Medical, Clearwater, FL) is a newer supraglottic airway device intended for use as a primary airway or a conduit for tracheal tube (TT) placement. The primary purpose of this study was to record the overall success rate and to determine if repeated performance of fiberoptic-guided TT insertion via the **air-Q®** ILA shortens insertion time in a manikin.

Methods

After IRB approval and written informed consent, the study procedure was reviewed and demonstrated to each participant. Participants experienced in fiberoptic-guided intubation but naïve to the ILA then performed the following step-wise procedure 5 times on an Airsim™ airway management trainer (Trucorp, Belfast, Ireland): *Step (1)* size 3.5 **air-Q®** ILA inserted, airway circuit connected, lung ventilation confirmed; *Step (2)* 7.0mm ID TT inserted into the ILA to 18cm, fiberoptic bronchoscope (FOB) directed beyond the vocal cords, TT advanced over the FOB into the trachea, TT placement above the carina visually confirmed, TT cuff inflated, airway circuit connected, lung ventilation confirmed; *Step (3)* ILA removed with ILA Removal Stylet (Mercury Medical), airway circuit connected, lung ventilation via TT confirmed.

Total procedure time (in seconds) was defined as the time from ILA pickup to confirmation of lung ventilation via the TT following ILA removal. Attempts were considered successful if ventilation was confirmed via the TT following ILA removal. Failure was defined as unsuccessful placement of the ILA after 3 attempts or dislodgement of the TT from the trachea occurring during or after removal of the ILA. The procedure times amongst the five attempts were compared using repeated measures ANOVA and between attempts using paired t-tests with Bonferroni correction. A p-value <0.05 was considered significant.

Results

Twenty (10 staff, 10 resident) anesthesiologists performed 5 FOB-guided TT placements using the ILA. Procedure times decreased from the 1st to the 5th attempt amongst all participants (102±29, 85±19, 75±16, 72±18, 68±14 s, $p<0.0001$, ANOVA) with a corresponding reduction in procedure time of 33.3%. Procedure times significantly decreased from the 1st to the 5th attempt by a mean difference of 34 seconds [95% CI (22-47s); $p<0.001$)]. Overall, 97% of attempts were successful with no ILA or TT placement failures occurring. All 3 failures occurred due to TT dislodgement with ILA removal.

Discussion

Our study demonstrates that FOB-guided TT placement through the **air-Q®** ILA is a quickly learned and highly successful technique. We recorded procedure times and a relative reduction in procedure time comparable to those previously reported by Wong, et al for blind TT placement through an ILA (68 to 102 s vs. 60.8 to 92.6 s and 33% vs. 34% respectively).[1] FOB guidance appears to significantly improve the success of TT placement rate as well, compared to blind TT insertion (100% vs. 84.6 to 90.8%). We conclude that FOB-guided TT insertion via the **air-Q®** ILA shows promise as a highly successful and rapid technique for tracheal intubation, particularly in a "rescue" situation where a supraglottic airway device is required. Further evaluation in humans is warranted.

References

1. Wong, et al. Repeated performance of tracheal tube insertion through intubating laryngeal airway on mannequins. Anesthesiology 2008; 109 A1175.

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A1571
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9:00:00 AM - 11:00:00 AM
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Three Methods of Fiberoptic-Guided Tracheal Intubation Via air-Q® ILA and LMA-Classic™ in a Manikin

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Introduction

The **air-Q®** Intubating Laryngeal Airway (ILA, Mercury Medical, Clearwater, FL) is a newer supraglottic airway intended for use as a primary airway or a conduit for tracheal tube (TT) placement. TT placement via the ILA may simplify tracheal intubation in a "rescue" situation where a supraglottic airway device is required. The purpose of this study was to compare the overall success rate and time required to complete a fiberoptic bronchoscope-guided (FOBG) tracheal intubation via the ILA compared to FOBG tracheal intubation via an LMA-Classic (cLMA, LMA North America, San Diego, CA) using the Aintree Intubating Catheter (AIC, Cook Critical Care, Bloomington, IN)[1] and the Arndt Airway Exchange Catheter Set (AECS, Cook Critical Care, Bloomington, IN).[2]

Methods

After IRB approval and written informed consent, each study procedure was reviewed and demonstrated to each participant. Participants then performed each procedure once in random order on an Airsim™ airway management trainer (Trucorp, Belfast, Ireland). *ILA Procedure*: size 3.5 ILA placed; ventilate; FOBG TT placed through ILA; ventilate; ILA removed using removal stylet; ventilate. *AIC Procedure*: size 3 cLMA placed; ventilate; FOBG TT placed through cLMA using AIC; ventilate. *AECS Procedure*: size 3 cLMA placed; ventilate; FOBG TT placed though cLMA using AECS; ventilate. Total procedure time in seconds was defined as the time from ILA or cLMA pickup to confirmation of ventilation via TT. Procedure success was defined as successful initial airway placement within 3 attempts and confirmation of ventilation at each appropriate step. Participants rated the procedures using a modified Likert scale. Mean procedure times amongst the three procedures were compared using repeated measures ANOVA and between procedures using paired t-tests with Bonferroni correction. User preference was compared using Chi-Squares. A p-value <0.05 was considered significant.

Results

Twenty (10 staff, 10 resident) anesthesiologists participated. Procedure times amongst the ILA, AIC, and AECS differed significantly (102±29, 87±47, and 130±28 s, $p<0.001$ ANOVA). Mean difference in seconds (95% CI) for AECS and ILA was 28 s (3.5-53 s), for AECS and AIC was 43 s (18-68 s), and for ILA and AIC was 15 s (-9.9-40 s). Sixty percent of participants preferred the ILA, 30% the AIC, and 10% the AECS ($p<0.003$). Two failures occurred with the ILA, both during attempt at ILA removal over the TT, while using the removal stylet. One AIC failure occurred when the AIC dislodged from the trachea during attempt at coaxial TT advancement. No AECS failures occurred.

Discussion

Our study is the first to compare three techniques of FOBG TT placement via the ILA and cLMA. The results demonstrate comparably high success rates between the three techniques with shorter times for the ILA and AIC versus the AECS and user preference for the ILA. Since use of the ILA may simplify tracheal intubation in a "rescue" situation, further study in humans is warranted.

References

1. Zura et al, Use of the Aintree intubation catheter in a patient with an unexpected difficult airway. Can J Anaesth 2005; 52(6): 646-649

2. Arndt et al, Intubation via the LMA using a Cook retrograde intubation kit. Can J Anaesth 1998; 45: 257-260.

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A335
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Managing the Difficult Airway in Children: Which Device When Laryngoscopy Will Not Suffice?

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Introduction

The difficult airway (DA) in children may be defined as the inability to visualize the vocal cords with laryngoscopy, difficulty with intubation or requiring specialized airway devices (SAD) to intubate, such as fiberoptic bronchoscope (FFB) or video laryngoscope (VL) (1, 2). Knowledge of limitations of SADs is critical to minimize problems at intubation (3).We present a study using different SADs in children with DAs.

Methods

Upon IRB-approval, a prospective and retrospective study was performed in children with DAs. Data collected included age, weight, gender, ASA status, diagnoses, procedure, past difficult larynoscopy/intubation, intubation aids, airway maneuvers, SADs, and anesthetic technique. "Difficult airway" was defined as the inability to visualize vocal cords with DL, difficult intubation with DL, the use of SADs, and problems encountered during intubation (oxygenation/ventilation).

Results

Thirty children had a total of 37 procedures (19 prospective, 18 retrospective). Mean ± SD (range) for age (years) and weight (kg) were 7.9 ± 6.5 (1 month- 19 years) and 30.7 ± 26.0 (2.3 – 84.0) for prospective study and 6.3 ± 5.5 (1 month- 18 years) and 18.8 ± 12.8 (3.0- 46.0) for retrospective study. DL was unsuccessful in 3/6 (50%) and 3/9 (33%) for the prospective and retrospective studies. A SAD was used to successfully intubate. A SAD was the initial device in 11 patients and used to successfully intubate 10 (91%) in prospective while a SAD was successful in all 7 retrospective (see Tables 1 and 2). Specialized ENT devices were used to intubate 3/11 (27%) and 3/7 patients (43%) for the prospective and retrospective studies.

Table 1- Airway devices used in children with difficult airways (Prospective)[figure1]*Indicates device unsuccessful in achieving intubation

**Patient underwent separate procedures at different times

Table 2- Airway devices used in children with difficult airways (Retrospective)[figure2]*Indicates device unsuccessful in achieving intubation

**Patient underwent separate procedures at different times

Discussion

We found a high failure rate when using conventional laryngoscopy in children with DAs. SADs were successful in intubating these children. However, SADs may fail in certain patients and one SAD may not be adequate since specialized ENT devices (Parson's laryngoscope/anterior commissure scope) were required. Further research is required in the use of SADs in pediatric DAs.

References

1. Ped Anesth 2009; 19 (Suppl 1): 77-87

2. Ped Anesth 2009; 19:1102-7

3. Ped Anesth 2009; 19:618-22.

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