

Wire-guided (Seldinger technique) intubation through a face mask in urgent, difficult and grossly distorted airways

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ABSTRACT

We report two cases of successful urgent intubation using a Seldinger technique for airway management through an anesthesia facemask, while maintaining ventilation in patients with difficult airways and grossly distorted airway anatomy. In both cases, conventional airway management techniques were predicted to be difficult or impossible, and a high likelihood for a surgical airway was present. This technique was chosen as it allows tracheal tube placement through the nares during spontaneous ventilation with the airway stented open and oxygen delivery with either continuous positive airway pressure and/or pressure support ventilation. This unhurried technique may allow intubation when other techniques are unsuitable, while maintaining control of the airway.

Key words: Airway management, difficult airway, difficult intubation, fiberoptic bronchoscopy, trauma, Treacher-collins syndrome, wire-guided catheter exchange

INTRODUCTION

The ability to secure a known difficult airway can be challenging, and one technique often is not suitable for all situations. As such, knowledge of various methods to secure a known difficult airway is advantageous. In 1953, Seldinger first described a wire-guided technique for exchanging of a femoral artery puncture needle for a flexible catheter, and this technique (i.e., the Seldinger technique) now forms the basis for arterial and venous cannulation throughout the fields of medicine and surgery, including anesthesiology.^[1] In a similar fashion, the use of a fiberoptic bronchoscope for guidewire placement, both transorally and through a previously placed laryngeal mask airway (LMA), followed by wire-guided tracheal tube placement, has been previously reported for management of difficult airways in adults and children, both within the operating room and within the intensive care unit.^[2-8] However, to the best of our knowledge, this technique has not previously

been performed through a standard anesthesia facemask to facilitate nasal tracheal tube placement, while providing respiratory support to maintain oxygenation and airway stenting. The technique described uses a 160 cm, coated Amplatz guidewire, a flexible pediatric bronchoscope, a 19 mm outer diameter (OD), 15 mm internal diameter (ID) bronchoscopy port and a 14 Fr, 70 cm, tapered tip, airway exchange catheter. Excluding the bronchoscope, these components are available, prepackaged in the Arndt Airway Exchange Catheter Set with Rapi-Fit® Adapters (AECS, Cook Critical Medical, Bloomington, IN, USA).

CASE REPORTS

Case 1

A 21-year-old female with Treacher-Collins syndrome was scheduled by her surgical team for urgent exploration and repair of a necrotic left facial skin graft. She was known to be a difficult intubation from her initial recent facial flap surgery. On presentation for the urgent surgery, the ischemic flap further distorted the airway secondary to inflammation and tissue ischemia. Further, ischemia caused gross tongue distortion and greatly narrowed mouth opening to the point where LMA placement or oral intubation would likely be impossible. Interincisal opening was less than 10 mm. During her previous anesthetic, attempted intubation using direct laryngoscopy with both Macintosh size 2 and 3 blades failed. Fortunately, she could

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be manually ventilated by the bag and mask technique and, ultimately, intubated using an AECS and the technique of Arndt *et al.* (Arndt *et al.*, Can J Anaesth, 1998).^[4]

Preoperatively, the airway was topicalized with 0.05% oxymetolazone and 4% lidocaine solution (10 mL) using a commercial disposable nebulizer. The patient was premedicated with midazolam (2 mg) and transported to the operating room, where standard ASA monitors were applied. Preoxygenation was instituted with 100% oxygen (6 L/min) via a standard anesthesia facemask using the anesthesia circuit. The anesthesia facemask was applied tightly using a disposable head strap, and the patient was allowed to breathe spontaneously, while the adjustable pressure leak valve of the anesthesia machine was closed to generate 5–10 cm H₂O of CPAP to stent the airway open. The AECS bronchoscopy port was then placed between the anesthesia facemask and the circuit, and aligned over the left nares. A pediatric flexible fiberoptic bronchoscope (FOB, Pentax FB-10 V, Pentax Medical, Montvale, NJ, USA) was advanced through the bronchoscopy port and the left nares, through the glottis and into the trachea without complication. The AECS guidewire was then threaded through the FOB working channel until it was visualized at the carina. The FOB was then carefully removed and the AECS exchange catheter was threaded over the guidewire into the airway through the anesthesia facemask. The facemask was removed and a 5.5 mm ID tracheal tube (Covidien, Mansfield, MA, USA) was advanced over the exchange catheter into the airway. The guidewire and catheter were removed and the tracheal tube cuff was inflated. Correct tracheal tube placement was confirmed by the presence of equal bilateral breath sounds, continuous positive end-tidal CO₂ and FOB. Propofol (60 mg) and fentanyl (25 mcg) were administered intravenously to induce general anesthesia. An oxygenation level of 98% or greater, as measured by pulse oximetry, was maintained throughout the procedure. All airway device surfaces had been previously lubricated with medical-grade silicone spray.

Case 2

A 53-year-old male, suffering from alcohol withdrawal, was transferred to our intensive care unit (ICU) with a tongue laceration causing profound tongue swelling and bleeding. His tongue protruded from his oral cavity and his mouth opening was <10 mm. An intubation attempt using direct laryngoscope had been unsuccessful at an outside hospital. Intubation was requested due to impending airway obstruction from the tongue swelling.

In the ICU, the patient was placed on 100% oxygen and bi-level positive airway pressure (BiPAP) support (20 cmH₂O inspiratory pressure/5 cmH₂O positive end-expiratory pressure), using an ICU ventilator and a standard anesthesia

facemask, held in place tightly with a disposable head strap. His airway was topicalized with 0.05% oxymetolazone/4% lidocaine solution (10 mL) using a nebulizer placed into the ventilator circuit. Midazolam (2 mg) and ketamine (25 mg) were administered intravenously. The AECS bronchoscopy port was placed between the anesthesia facemask and the ventilator circuit, and aligned over the left nares. A pediatric bronchoscope (Pentax FB-10 V, Pentax Medical) was advanced through the bronchoscopy port and the left nares, through the glottis and into the trachea. The AECS guidewire was then threaded through the FOB working channel until it was visualized at the carina. The FOB was then carefully removed and the AECS exchange catheter was threaded over the guidewire into the airway through the anesthesia facemask. The anesthesia facemask was removed and a 7.0 mm ID (Covidien) tracheal tube was inserted over the exchange catheter. The guidewire and catheter were removed and the tracheal tube cuff was inflated. Correct tracheal tube placement was confirmed by the presence of equal bilateral breath sounds, colorimetric end-tidal carbon dioxide detection and FOB. On arrival to the ICU, the patient's oxygen saturation, as measured by pulse oximetry, was 92% on supplemental oxygen delivered by nasal cannula (4 L/min). This improved to 97% with the application of BiPAP, and was maintained at this level or higher during the intubation procedure. All airway device surfaces had been previously lubricated with medical-grade silicone spray. This technique does require more steps and potentially more time to perform than fiberoptic bronchoscopy alone. However, in both reported cases, the duration of fiberoptic bronchoscopy and tube exchange was less than 2 min.

DISCUSSION

In patients with known or suspected difficult airways and grossly distorted airway anatomy, intubation by conventional means may be extremely difficult or impossible. Our cases demonstrate the flexibility and usefulness of wire-guided (Seldinger) airway management with the integration of ventilatory support for oxygenation and airway stenting.

Treacher-Collins syndrome is a congenital deformity associated with mandibular and maxillary hypoplasia. Retrognathia can be severe enough to result in upper airway obstruction and difficulties with tracheal intubation. Proposed techniques for managing airway challenges in Treacher-Collins syndrome include direct laryngoscopy, fiberoptic bronchoscopy, blind light wand techniques, blind nasal techniques, LMAs and tracheostomy.^[9,10] The LMA has been used as a conduit for FOB-guided tracheal intubation in Treacher-Collins patients.^[11] It has also been suggested that nasal intubation, while orally mask ventilating the patient and obstructing the contralateral

nares, may be a useful airway management technique for these patients. This method has the advantage of limiting apnea and allowing more time for bronchoscopy.^[10]

Trauma has the potential to create disastrous airway management scenarios. Tongue hematomas can rapidly progress to severe airway obstruction, requiring life-saving intubation. They cause airway obstruction by displacing the tongue posterocephalad. Life-threatening tongue hematomas have been previously reported following alcohol withdrawal-related seizures. In one case, awake fiberoptic bronchoscopy was used to secure the patient's airway.^[12] In another report, coagulopathy precluded nasal intubation. Airway securement was avoided in this patient by aggressively minimizing further airway edema with steroid administration and correction of coagulopathy.^[13] Other causes of significant tongue swelling include edema, infarction and infection.^[13]

Wire-guided intubation using the AECS has been previously reported through LMA devices.^[14] This set may offer particular advantages in critically ill patients requiring intubation outside the operating room.^[8] It offers unhurried fiberoptic instrumentation of the airway, while permitting oxygenation and ventilation nearly throughout the entire intubation procedure, when a LMA is used as an intubating conduit. The diameter of the AECS guidewire is 0.38 mm, which fits through the working channel of all but neonatal bronchoscopes, and enables its use with small caliber bronchoscopes, which can be less-stimulating to the patient and perhaps passed more easily through the nasal and/or edematous airway. The guidewire is also of adequate length (160 cm) to facilitate guidance for nasal intubation. Once the guidewire and airway exchange catheter are in place, 5.0 mm ID or greater tracheal tubes can be placed, while still maintaining airway control. Tracheal tubes of smaller IDs can be advanced over the guidewire alone.

In patients where mask or spontaneous ventilation is possible, our technique allows airway stenting and oxygenation with either CPAP or pressure support ventilation. Intubation through an anesthesia facemask using a guidewire and FOB may be a good alternative method of airway securement in select patients. This method allows time to navigate the airway, maintain ventilation and oxygenation and secure a definitive airway

in patients with grossly distorted airway anatomy and at high risk for requiring a surgical airway.

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