Intubation Bougie Dissection of Tracheal Mucosa and Intratracheal Airway Obstruction

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Intubation bougies are commonly used to aid in intubation when an optimal view of the larynx is not obtained. We describe a case of tracheal perforation using a disposable intubation bougie resulting in a complete intratracheal airway obstruction relieved by cricothyrotomy. Disposable intubation bougies may have mechanical properties that differ from their nondisposable counterparts making complications more likely.
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The reusable gum–elastic bougie is a reliable tool to assist intubation of patients with a difficult airway. Single-use intubation bougies have been created with the proposed advantage of decreasing the risk of infectious transmission. We report a case where a "cannot intubate, cannot ventilate" scenario resulted from the use of a disposable intubation bougie, which created a false tissue passage in the trachea and a complete obstruction, which was resolved by surgical cricothyrotomy. This is a highly unusual and severe complication, which has not been previously reported.

CASE REPORT

A 56-yr-old, 101 kg, ASA II female presented for an elective laparoscopic ventral hernia repair. Her medical history was remarkable for hypertension, anxiety, and a prior abdominal hysterectomy. Her airway examination revealed a Mallampati 2 airway, thyromental distance of 3 fingers and she extended her neck well. An 18-gauge IV was started, and after placement of routine monitors and administration of oxygen, induction was smooth with 2 mg of midazolam, propofol 100 mg IV, lidocaine 200 mg IV, and vecuronium 10 mg IV. A bag and mask airway was easily achieved before and after muscle relaxation. Direct laryngoscopy (DL) was performed sequentially with a Macintosh three and four blade. The best view that could be obtained was a grade 2b view. Because of the difficulty with the laryngosopy, to minimize trauma and facilitate intubation, we chose to use a disposable intubation bougie. A single-use intubation bougie (15F × 70 cm coudie tip, SunMed Largo, FL) was passed with the "hockey stick" directed anteriorly through the glottis and advanced until gentle resistance was felt approximately 25 cm to the lips. A 7.0-mm ID endotracheal tube (ETT) was advanced over the intubation bougie easily and the bougie removed. Ventilation was impossible using the bag of the anesthesia machine. The ETT was removed revealing a small amount of blood on the tip. A bag and mask airway was attempted unsuccessfully and DL was repeated by a more experienced provider, again demonstrating a similar glottic view. The intubation bogie was placed without problem and the ETT again passed over. Again, there were no capnogram or breath sounds with attempted bag ventilation using the anesthesia machine. The ETT was withdrawn and contained blood. A bag and mask airway using two hands could not be established. A #4 and #5 classic laryngeal mask airway (LMA) also failed to establish an airway. In all instances, there was no chest wall movement, breath sounds, or capnogram. When the oxygen saturation had decreased to 50%, the decision was made to perform an emergency surgical cricothyrotomy. As the skin was incised, a rush of air was released. Suddenly, with positive pressure ventilation, the bag and mask airway could be established, breath sounds were present, the capnogram returned, and the patient's oxygen saturation recovered over several minutes to more than 90%. A #4 classic LMA was placed and ventilation was established. A bronchoscope was advanced through the LMA using a bronchoscopy port and a 140-cm guidewire advanced through the bronchoscope into the airway through the LMA. A Cook Tube changer (Cook Critical Care, Bloomington, IN) was advanced over the guidewire through the LMA. The LMA was then removed and a 7.0-mm ID ETT easily passed over the tube changer into the trachea. Bronchoscopy by a thoracic surgeon revealed no intrathoracic tracheal damage. The trachea in the neck was then examined with a pediatric bronchoscope and revealed a defect in the membranous trachea below the larynx. Exploration of the cervical trachea using the neck wound demonstrated a rent in the posterior tracheal mucosa into which the single-use intubation bougie and ETTs had passed. Air had been insufflated during attempted ventilation and the membranous trachea ballooned forward, creating an intratracheal obstruction. The trapped air was released by the cricothyrotomy incision, allowing the airway to reopen with positive pressure ventilation. The patient was treated with prophylactic antibiotics and tracheally extubated within 24 h and enjoyed an uneventful recovery.

DISCUSSION

The gum–elastic bougie has been successfully used to aid endotracheal intubation for decades. In fact, in the United Kingdom, it is the first-choice method by most anesthesiologists after DL. In patients with a

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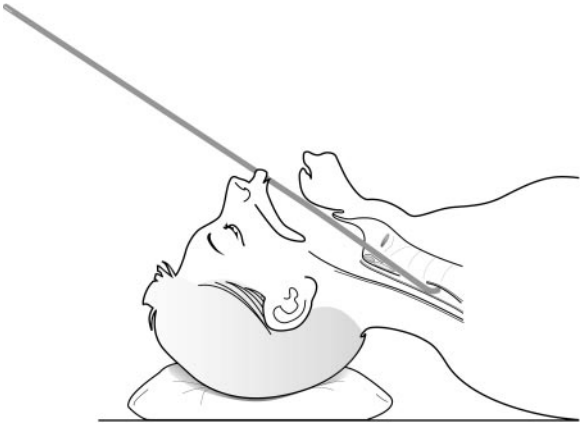

Figure 1. The intubation bougie has passed through the posterior mucosal surface of the trachea creating a false lumen.

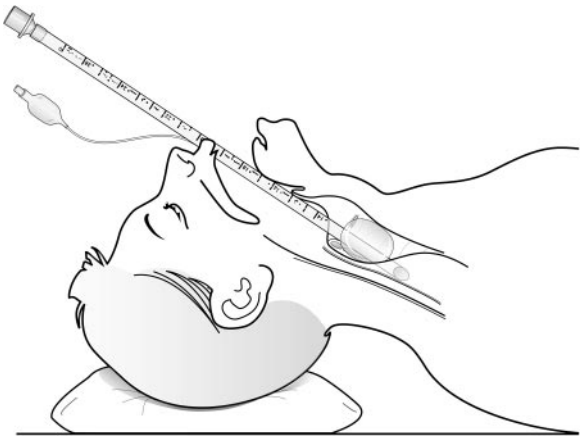

Figure 2. The submucosal placement of the endotracheal tube and positive pressure ventilation created an intraairway obstruction by ballooning the posterior membranous tracheal wall forward. It was relieved after cricothyrotomy, allowing a passage for the trapped air to escape and the airway to reextend with position pressure ventilation.

Cormack and Lehane grade 2–4 laryngeal view, it is successful in the majority of cases[1] with a comparable success rate to bronchoscopic-guided intubation of manikins with a grade 3 airway.[2] Serious complications related to bougie use, such as airway trauma, are rare; in fact, they are limited to a few case reports. Kadry and Popat described a pharyngeal anastomotic perforation by the bougie in a patient needing reintubation after a partial glossectomy with radical neck dissection.[3] Prabhu et al. described bleeding of the tracheobroncheal tree and subsequent clotting of the right mainstem bronchus after an uneventful bougie-guided intubation.[4] Smith reported a tracheal abrasion and a hemopneumothorax after an uncomplicated bougie-assisted intubation.[5] There has not been, to our knowledge, a case where frank cervical laryngotracheal perforation of the membranous trachea has created false tissue passage causing a complete airway obstruction secondary to the use of an intubation elastic bougie. Development of single-use intubation elastic bougies was prompted by concerns of transmitting infections with inadequately cleaned multiuse units.[6] Concerns with the single-use units have involved its relative stiffness which may impact its reliability and safety. Two studies have demonstrated that the single-use unit is significantly more stiff and able to transmit 2–3 times higher forces to its tip than the multiuse unit.[7,8] Interestingly, studies have also demonstrated that the Portex single-use bougie is actually significantly less successful in securing a difficult endotracheal intubation than the multiuse counterpart in manikin simulations of a human grade 3a airway.[9]

We describe a very rare airway injury in which an intubation bougie perforated the posterior tracheal mucosa just distal to the glottis and created a false lumen dissecting under the cervical membranous trachea (Fig. 1) after positive pressure ventilation with an ETT. This flap occluded the tracheal lumen and prevented further supraglottic ventilation (Fig. 2). We are uncertain how an anteriorly directed bougie entered the posterior membranous trachea and the subglottic abnormality that the bougie encountered, most likely caused the dissection and posterior flap to form. This case brings to question the safety of the single-use bougie, which is made using a die extrusion process, as opposed to the multiple use unit, which is made of a coated woven material. As the manufacture process of both devices is different, the mechanical properties of the two devices also appear to be very different. Our case happened within 1 yr of when the single-use unit was introduced into clinical practice at our hospital and prompted its replacement with the more flexible nondisposable counterpart. Our case also demonstrates that the ASA difficult airway protocol is an important guide to "the cannot intubate, cannot ventilate" scenario, even when the underlying etiology of failure to ventilate is unclear.

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