A NEW MANEUVER FOR ENDOTRACHEAL TUBE INSERTION DURING DIFFICULT GLIDESCOPE INTUBATION

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Abstract—Background: The GlideScope® Video Laryngoscope (Verathon, Bothell, WA) is a video laryngoscopy system that can be used for routine intubation, but is also commonly used as an alternative for difficult or failed airways. Previous reports have identified a very high incidence of grade 1 and grade 2 Cormack-Lehane glottic views, but despite these high-grade views, intubation is sometimes difficult due to the angle of insertion and shape of the endotracheal tube. Several maneuvers have been reported to improve the likelihood of successful endotracheal tube placement in these uncommon cases of failure. Case Report: We report the case of a patient who could not be intubated with the GlideScope® despite an easily obtained grade 1 laryngoscopic view. The impediment to intubation was identified as a sharp angulation of the trachea with respect to the larynx, such that the trachea formed a steep posterior angle with the laryngeal/glottic axis. Intubation was achieved using a previously unreported maneuver, in which the endotracheal tube with a sharply curved malleable stylet was inserted through the glottis, and then rotated 180° to permit passage down the trachea. Discussion and Conclusion: We believe that this maneuver may be useful in other cases of failed GlideScope® intubation, when a high-grade laryngeal view is obtained but tube passage is not possible due to a sharp posterior angulation of the trachea. © 2010 Elsevier Inc.

INTRODUCTION

The GlideScope® Video Laryngoscope (Verathon, Bothell, WA) is a video laryngoscopy system with a two-segment blade, the distal portion of which houses a charge-coupled device that contains a micro-video camera that transmits images to a 7-inch video liquid crystal display (LCD) monitor. The GlideScope® can be used for routine intubation, but is also commonly used as an alternative device for difficult or failed airways. It is particularly useful in cases where cervical motion or mouth opening is limited, preventing creation of a “straight line” of sight from the operator to the glottis. In one study comparing direct laryngoscopy to GlideScope® laryngoscopy in 400 patients, all patients had grade 1 or 2 Cormack-Lehane views (grade 1: full glottic view, grade 2: partial glottic view, grade 3: epiglottis visible but no glottic view; grade 4: epiglottis not visible) with the GlideScope®, despite 6% and 0.5% having grade 3 and 4 views, respectively, during direct laryngoscopy (1). The tradeoff for the excellent glottic view, however, is that the endotracheal tube must be shaped to a much more severe angle (or curve) to facilitate insertion, to match the angle of attack of the laryngoscope. This usually does not present a problem, and the insertion technique is fairly easily learned even by novice operators (2). However, intubation failures can occur despite excellent visualization (3,4). There have been a
number of maneuvers suggested to increase the success of passing the endotracheal tube when glottic visualization is excellent and the tube is not easily passed using usual methods. Here we describe a maneuver for use when the trachea is sharply angulated in relation to the larynx, and the anterior tracheal wall prevents tube passage.

**CASE REPORT**

A 53-year-old man presented with fever and abdominal pain in the context of a past medical history of chronic lymphocytic leukemia, small lymphocytic lymphoma, and hepatitis C. He had recently undergone stem cell transplantation and was on immunosuppressive therapy. Before transfer to our facility the patient received intravenous fluids and broad-spectrum antibiotics. He was intermittently awake and somnolent, with a temperature of 37.6°C (99.6°F), pulse of 128 beats/min, respiratory rate of 20 breaths/min, blood pressure of 103/87 mm Hg, and an oxygen saturation of 100% on a non-rebreather mask. Examination revealed clear breath sounds, tachycardic but otherwise normal heart sounds, and diffuse abdominal tenderness without rebound or guarding. Despite 4 L of crystalloid solution, the patient’s systolic blood pressure dropped to 80 mm Hg, and he was in moderate respiratory distress. Intravenous vasopressor therapy and additional antibiotic coverage were initiated and the patient was assessed for emergency endotracheal intubation. The patient’s airway was assessed using the “LEMON” method (Figure 1) and did not demonstrate any predictors of difficult intubation (5). The patient was pre-oxygenated and then rapid sequence intubation was performed using ketamine and succinylcholine as induction and neuromuscular blocking agents. The GlideScope® was gently inserted between the teeth in the midline and advanced into the vallecula, revealing a Cormack-Lehane grade 1 view of the glottic aperture. The endotracheal tube had been shaped with a conventional malleable stylet to match the curve of the GlideScope®, and was introduced into the mouth and aligned with the glottic opening. It was advanced through the vocal cords under video visualization, and the stylet was withdrawn several centimeters, but the tube could not be further advanced. The tube was gently rotated 45° to 90° clockwise, and manipulated, but the tube consistently impinged on the anterior tracheal wall and could not be advanced. The attending physician then took over for the resident performing the intubation, and noted that the trachea had a sharp posterior angulation in relation to the larynx, and the anterior wall of the trachea appeared to descend posteriorly at a steep angle in relation to the line of insertion of the endotracheal tube through the glottic aperture. Relaxation of the tilt of the GlideScope® to reduce angulation did not improve this relationship. The patient’s oxygen saturation remained above 93%. The attending physician then placed the endotracheal tube through the glottic opening with the stylet in place, and did not withdraw the stylet. Using the vocal cords to anchor the distal end of the tube, he rotated the endotracheal tube clockwise 180° on its axis, causing the sharp angulation of the endotracheal tube as shaped by the stylet to match the sharp posterior angulation of the trachea. The tube was then easily advanced into the trachea with the stylet in place and the stylet was then removed. The endotracheal tube cuff was inflated and placement was confirmed by colorimetric end-tidal CO₂ detector and auscultation.

After securing the airway, the patient was sedated and transferred to the Medical Intensive Care Unit for continued management.

**DISCUSSION**

The GlideScope® is usually inserted in the midline of the mouth and the tip advanced into the vallecula or to the posterior surface of the epiglottis. To optimize visualization of the glottis, the GlideScope® is then tilted, unlike a conventional laryngoscope, which is lifted. Although visualization is typically superior to that achieved using direct laryngoscopy, insertion of the endotracheal tube can be more complicated for two reasons. The first is that the hand-eye coordination needed to direct the tube under video visualization is different from that required for simple tube placement under direct visualization, and must be learned. Secondly, the distal portion of the GlideScope® blade, where the camera is located, is angled at 50°–60°, which means that the tube needs to traverse a steep angle for passage from the mouth, through the vocal cords and into the trachea (5). A number of strategies have been described for overcoming this limitation. Methods of optimizing tube shape using a stylet include bending the endotracheal tube (ETT) in a smooth curve to match the angle of the GlideScope® blade (curve of 60°), using a proprietary non-malleable
stilet manufactured to that angle, bending the tube at a right angle proximal to the cuff or curving the stilet and tube in a smooth 90° angle (5,6). Once shaped, the standard procedure is to place the tube into the mouth under direct visualization until it appears that the tube is positioned close to the distal end of the laryngoscope blade, then use video visualization to manipulate the tube to advance it through the vocal cords. Due to the anterior angulation of the tube, the stilet usually is withdrawn several centimeters after the tube has traversed the glottis, to facilitate its advance into the trachea, as otherwise, the tube is prone to impingement on the anterior tracheal wall (5).

Early experience with the GlideScope® has demonstrated an improvement in Cormack-Lehane glottic view compared to conventional laryngoscopy, but also that failures tend to occur despite a good or excellent view (3,4). In one study of 728 patients, 702 (96%) were intubated successfully. Of the 26 failures, 14 occurred on patients for whom there was a Cormack-Lehane grade 1 view (3). Another study of 400 GlideScope® intubations had only one failure, but that occurred in a patient with a grade 1 laryngoscopic view (1). In a letter, authors reported 25/120 intubations with difficulty passing the tube despite a good view (7). A randomized controlled trial of the GlideScope® found an improvement in the Cormack-Lehane grade with the GlideScope®, but a slightly longer time to intubation, which was attributed to the additional time required to manipulate the ETT through the vocal cords (8).

A number of maneuvers have been described to ease passage of the ETT. These include withdrawing the GlideScope® slightly or reducing its tilt to allow the larynx to shift downward for easier passage of the tube; or switching to the GlideRite® ETT (Verathon) with a soft and tapered tip for easier passage over the arytenoids or other possible impingement points (5). Kramer and Osborn describe a series of maneuvers involving rotation of the ETT over the arytenoids or into the glottic opening (9). Cho and Kil proposed deliberately skewing the GlideScope® blade slightly to the patient’s left to enhance access to the glottis (7). Cooper advocated using a reverse camber on the ETT, in which the stilet is inserted and shaped, but in the direction opposite the natural bend of the ETT, such that that when the stilet is withdrawn, the ETT “corrects” its sharp anterior curvature and therefore impinges less on the anterior tracheal wall (10). When this approach was studied in a randomized trial involving 200 patients, however, it did not seem to improve tube placement success or time (6). Neustein suggested rotating the tube to the right after the distal end passes through the vocal cords, while using the thumb to remove the stilet (11,12).

In our patient, excellent (Cormack-Lehane grade 1) visualization of the vocal cords was easily achieved, but we were not able to pass the tube beyond tip insertion through the glottis due to impingement on the anterior tracheal wall. This impingement continued to prevent passage after the stilet was withdrawn several centimeters, and despite rotation of the tube 90° and relaxation of the angle of tilt of the Glidescope. We suspected that the extremely sharp angulation of the trachea with respect to the larynx was the culprit, and so rotated the tube, with the stilet fully inserted, 180° clockwise so that the tube was now angulated posteriorly to match the direction of travel of the trachea. By using the glottis to immobilize the distal end of the tube, the rotation was completed without losing the glottic insertion, and the tube then was easily advanced with the stilet in place.

CONCLUSIONS

To our knowledge, this maneuver previously has not been described, and may facilitate GlideScope® intubation in patients with an excellent glottic view but difficult tube passage caused by intractable impingement on the anterior tracheal wall.

REFERENCES