

## Case Report

## Use of Glidescope in Trial Extubation of the Difficult Airway

Narjeet Khurmi, MD<sup>1</sup>, Efrain Cubillo IV, MD<sup>2</sup>Mayo Clinic Arizona, Department of Anesthesiology, 5777 East Mayo Boulevard, Phoenix, AZ 85054<sup>1,2</sup>

Received date: 19-01-2016; Accepted date: 16-02-2016; Published date: 20-02-2016

**CORRESPONDENCE AUTHOR:** Narjeet Khurmi, MD**E-mail:** khurmi.narjeet@mayo.edu; Phone: 480-342-1800; Fax: 480-342-2319**ABSTRACT:**

It is not uncommon for patients to arrive in the operating suites with potential airway issues. These patients include pregnant woman, patients with cervical spine arthritis, the morbidly obese and patients who have had multiple and prolonged intubations. An estimated 40% of the adult population is deemed to be obese based on Body Mass Index.<sup>1,2</sup> Many intubated patients experience a degree of laryngeal edema or swelling (see figure 1 and 2). However, symptoms typically remain subclinical. Frequent laryngoscopy can lead to laryngeal edema and trauma. The duration of endotracheal intubation is directly correlated to degree of edema. Intraoperative fluid management and fluid shifts can also aggravate laryngeal edema. Early re-intubation (0-72 hours post-extubation) occurs about 12% of the time.<sup>5</sup> Safely managing a difficult airway (expected or unexpected) is critical to the overall well-being of the patient. Many evaluations and precautions are taken at the onset of an anesthetic. One should be just as vigilant at the conclusion of an anesthetic involving a challenging airway to avoid post-extubation complications. While guidelines to safely plan and perform extubation exist, the use of modern technology seems to be less prevalent. Using a video laryngoscope to evaluate the airway prior to extubation can be a valuable adjunct in the overall assessment of readiness to extubate a patient. In this report we describe a case of failed extubation and the ultimate use of video laryngoscopy to assist in the decision making process to extubate or perform a tracheostomy.

**KEY WORDS:** difficult airway, extubation, video laryngoscope, obesity**KEY MESSAGES:** In the setting of a known or suspected difficult airway, a video laryngoscope should be on the short list of tools that can be used to successfully extubate the patient.**INTRODUCTION**

When encountering a patient with a known or suspected difficult airway, health care professionals take appropriate care to manage the airway in a safe manner. The art and science of managing the difficult airway has been studied extensively – the result of this careful analysis has led to many practice recommendations. These range from performing awake intubations, proper “sniff” positioning, ensuring the ability to mask ventilate the patient prior to administering intravenous muscle relaxant, to using advanced airway tools, such as the flexible fiberoptic bronchoscope, fast-track LMA, video-laryngoscopes, etc. Since 1993 a better understanding and appreciation of the difficult airway algorithm coupled with advanced airway tools has led to a decrease in negative outcomes related to tracheal intubation.<sup>1,2</sup> However, the rate of serious negative airway-related events in the

operating room or PACU after tracheal extubation has not changed for the better during the same time frame.<sup>1, 3, 4</sup> The risk of post-extubation airway obstruction in the general population is roughly 4%. Roughly 12% of extubated patients require reintubation with 72 hours of extubation.<sup>4, 5</sup> The use of advanced fiberoptic videolaryngoscopes (McGrath, Glidescope) has increased over the years, resulting in far fewer unintended airway emergencies at the onset of an anesthetic. It is clear that what was a difficult airway at the beginning of a case will continue to be a difficult airway at the end of the case. It is estimated that 5-20% of extubations fail.<sup>6</sup> Therefore, paying attention to the recommended extubation criteria is critical at this point. Trial extubation in patients that have difficult airways typically involves the use of a wire or tube exchanger – which facilitate rapid reintubation

in the event the patient does not tolerate being without an endotracheal tube. Challenging airways arise in a variety of patients presenting for different surgeries: 1)geriatric patients with rigid and arthritic necks<sup>1, 7</sup>, 2)obese and morbidly obese patients<sup>1, 8, 9</sup>, 3)pregnant patients<sup>1, 9, 10</sup>, 4)patients undergoing cervical spine surgery<sup>1, 11</sup>, 5)patients undergoing major head and neck procedures<sup>1, 9</sup> and 6)patients who have had multiple laryngoscopies and prolonged intubations. For the purpose of this publication, we will focus on the obese patient who has been intubated multiple times in a short period.



**Figure 1.** Noticeable edema of the free edge of the vocal folds with heightened vascular pattern as well as interarytenoid mucosa edema and erythema.<sup>13</sup>



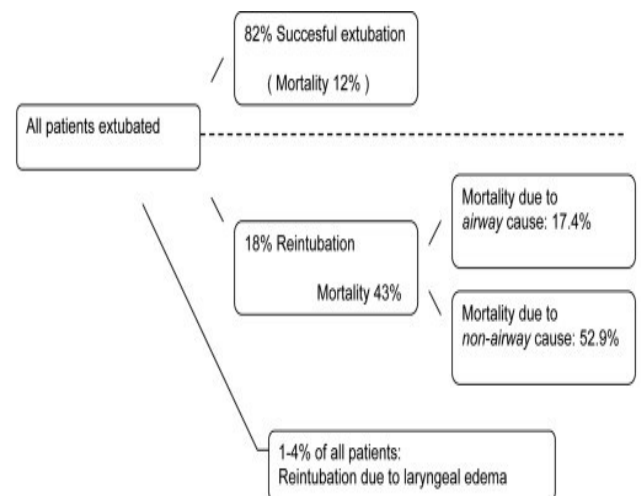
**Figure 2.** Significant vocal cord edema: Vocal cord edges irregular and complete closure against each other impeded.<sup>13</sup>

#### **PATHOGENESIS:**

Obesity in the United States is on the rise. An estimated 40% of the adult population is deemed to be obese based on Body Mass Index (BMI) calculations (BMI > 30kg/m<sup>2</sup>).<sup>12</sup> Very often these patients have excess oropharyngeal tissue, large tongues and small mouths relatively to tongue size. Furthermore, body habitus contributes to the challenging intubating circumstances. Many intubated patients experience a degree of laryngeal edema or swelling. However, most of the time symptoms remain subclinical and the swelling and inflammation is self-limiting. Edema is thought to be a result of pressure and ischemia from the endotracheal tube. In addition, frequent laryngoscopy in these patients can lead to laryngeal edema and trauma. Furthermore, duration of endotracheal intubation is directly correlated to degree of edema. Intraoperative fluid management and fluid shifts can also aggravate laryngeal edema.<sup>5</sup>

#### **INCIDENCE:**

The incidence of post-extubation respiratory compromise varies widely and is due to a variety of factors: residual neuromuscular blockade, excess narcotic effect, pulmonary edema, anatomic obstruction. Early re-intubation (0-72 hours post-extubation in OR or PACU) is about 12%.<sup>5</sup> Most reintubations after extubation failures occur between 0-2 hours post-extubation, and seldom after 24 hours.<sup>1, 17</sup> Reintubation is associated with higher morbidity (prolonged ventilation and ICU admission and increase risk of infection). Interestingly, airway obstruction as a cause for reintubation is associated with a lower mortality rates compared with non-airway causes for reintubation (see figure 3).<sup>18</sup>



**Figure 3:** Incidence of reintubation and mortality<sup>18</sup>

**Case History:**

The patient is a 41yo morbidly obese African American female with a history of post-preeclampsia renal failure that required dialysis. Ultimately, this patient underwent 2 separate kidney transplantations. After the initial allograft she thrombosed the renal vein and had to undergo graft nephrectomy. Subsequently, she received a second kidney transplant at which point she experienced acute antibody-mediated rejection. The patient arrived at our facility for a third renal allograft (deceased donor). Post-operatively the patient re-thrombosed the transplanted organ. She returned the following day for explant of thrombosed allograft. The anesthesia record from the prior day's surgery indicated that the patient had a marginally difficult airway – but was secured without issue using a MAC 3 laryngoscope. Prior to arriving to OR for explant of allograft, we were notified that the patient had not received any form of hemodialysis – but that it was planned for post-operatively. The patient was also chronically anticoagulated in hopes to avert thrombosed allograft. Upon entering the OR, the patient was transferred to the operating room table. She was placed in the supine position with adequate shoulder rolls to assume an optimal “sniff position”. Induction of anesthesia was accomplished with fentanyl 50mcg IV and propofol 200mg IV. Upon establishing adequate mask ventilation, the patient received Rocuronium 50mg IV. The initial laryngoscopy proved to be quite challenging secondary to a large tongue and swollen oropharyngeal tissue and resulted in an esophageal intubation. Repeat laryngoscopy proved even more difficult because of increased bleeding. Visualizing the vocal cords with a glidescope was successful and a 7.0 ETT was placed in the trachea. The operation proceeded without further issue. At the conclusion of the operation volatile agent was discontinued and neuromuscular blockade was fully reversed with 5mg neostigmine (demonstrated with 4/4 TOF and sustained tetanus with nerve stimulator). The patient was breathing spontaneously with tidal volumes 300-400ml per breath. She opened her eyes to verbal command. She demonstrated strong head lift. Due to the significant swelling in oropharynx, we elected to be cautious and perform an endotracheal tube leak test. The distal cuff on ETT was deflated. We observed loss of tidal volume of about 50-100ml. The ETT was disconnected from the breathing circuit and the proximal end of the ETT was occluded. We listened for audible breath sounds around the ETT – which were heard marginally. In our opinion the patient met criteria for extubation and the ETT was

removed. The patient was placed in reverse Trendelenburg at about 30 degrees. A mask was placed over the patient's face. Minimal to no end tidal CO<sub>2</sub> was measured. The patient progressively became confused, restless and obtunded with declining oxygen saturations. With mask ventilation, the patients CO<sub>2</sub> and SpO<sub>2</sub> returned to normal and the patient became more alert. The process repeated itself for about 30 minutes at which point reintubation secondary to apparent airway obstruction. Using the glidescope we successfully intubated the trachea – however with a 6.0 ETT as there was substantial and increased laryngeal swelling. The patient was transferred to ICU. She remained intubated and sedated for the next 72 hours. During this time the patient received IV dexamethasone and two rounds of hemodialysis. After 72 hours she returned to the operating room for a trial extubation/possible tracheostomy. Prior to arriving to the operating room the patient was awake and alert and comfortable on CPAP. The patient was transferred to the operating room table where she was placed supine and in reverse Trendelenburg at a 30 degree angle. The patient was induced with a propofol bolus. With the patient spontaneously ventilating, an ETT leak test was performed. Adequate breath sounds were audible around the deflated ETT. A glidescope was inserted and a visual analysis of the oropharynx and larynx was performed. It was deemed that whatever edema and swelling existed days before had subsided. The patient was awoken and extubated successfully without further sequelae.

**DISCUSSION:**

There are more than 50 subjective and objective tools and predictors to assess readiness for extubation. A short list of the most frequently used criteria is summarized in Table 1.

Patients with difficult airways pose significant challenges to those charged with providing safe medical care. In the operating room setting much planning and preparation is done to appropriately manage potential airway issues at induction. Advanced airway devices are readily available to practitioners to safely navigate the difficult airway algorithm. Hospitals and other anesthetizing locations are starting to collect data on early reintubation rates – either in the operating room, PACU or ICU. This points to the relative rise in reintubation rates. Notwithstanding, post-operative respiratory compromise can occur any time for a variety of reasons and requires immediate attention. Causes for postextubation upper airway obstruction are numerous and can be classified based on the anatomical segment of the airway involved.

Pharyngeal obstruction is common in obese patients and those with obstructive sleep apnea (OSA). Laryngeal obstruction is due to laryngeal edema and swelling secondary to frequent laryngoscopy and intubation, being in Trendelenburg position, fluid overload, long term effect of neck radiation and prolonged intubation.<sup>9, 19, 20, 21</sup> Postoperative bleeding related to surgery or concomitant anticoagulant or NSAID therapy.<sup>1, 22</sup> Masses and lesions in and around the airway are also of concern. The residual effects of drugs such as neuromuscular blockers and narcotics can cause patients to hypoventilate and require ventilatory assistance or reintubation.<sup>1, 23, 24</sup> The impetus to reintubate a patient is left to the judgment of the physician at hand. However, it is prudent to assess the types of patients that require repeat airway management after perceived successful extubation. Obesity is an epidemic that continues to worsen year by year. These patients have body habituses and airway anatomy that predispose them to challenging airways. Obese patients arrive daily for all types of operations – from orthopedic to urologic to gynecologic to ENT and advanced general surgery cases. Whether or not these patients undergo “corrective” procedures to aid in their obesity management, the patient with a declared difficult airway at the onset of the anesthetic will continue to have a difficult airway at the conclusion of surgery. It is imperative that anesthesia providers remain extra vigilant in assessing the readiness of the obese patient, as reintubation has clearly been shown to be associated with higher mortality and morbidity.<sup>18</sup>

Historically, patients undergoing trial extubation are brought to the operating room. In the presence of a qualified surgeon to perform an emergent tracheostomy, the patient is evaluated for potential extubation. Generally the cuff-leak test has been utilized to assess the potential for post-extubation stridor from prolonged intubation. However, there is research to suggest that the cuff-leak test demonstrates poor correlation in predicting successful or failed extubation.<sup>15, 16</sup> Typically, once the patient has met sufficient subjective and objective extubation criteria<sup>14</sup>, a wire or tube exchange device is inserted into the ETT and the patient is extubated. In the event of persistent airway obstruction and respiratory compromise a new ETT can readily be reinserted over the in situ wire or tube exchanger. Many publications have highlighted the use of advanced fiberoptic intubating devices in the setting of a difficult airway at the onset of an anesthetic. By using the glidescope to assess the degree of pharyngeal and laryngeal edema in an obese

patient who has had multiple airway instrumentations and who is potentially fluid overloaded secondary to being anephric and third spacing, one might elect to keep the patient intubated at the conclusion of surgery. This would obviate the need to rescue the unforeseen obstructed difficult airway. It may be prudent to add this technique to the list of assessment points in determining whether a patient can be extubated safely and successfully.

**Table 1.** Criteria for routine “awake” extubation<sup>14</sup>; Adapted from: Clinical Anesthesia. Barash P, Cullen B, Stoelting R<sup>14</sup>

Subjective Clinical Criteria	Objective Criteria
follows commands	vital capacity $\geq$ 10ml/kg
clear oropharynx/hypopharynx (i.e. no bleeding and all secretions cleared)	peak voluntary negative inspiratory pressure $>20$ cm H <sub>2</sub> O
intact gag reflex	tidal volume $>6$ ml/kg
sustained head lift for 5 seconds; sustained hand grasp	Sustained tetanic contraction (5 sec)
adequate pain control	T1/T4 ratio $>0.7$
minimal end expiratory concentration of inhaled anesthetics	Alveolar-Arterial PaO <sub>2</sub> gradient $<$ 350mmHg (FiO <sub>2</sub> 1.0)
	Dead space to Tidal Volume ratio $\leq$ 0.6

#### REFERENCES:

1. Cavallone L, Vannucci A. Extubation of the Difficult Airway and Extubation Failure. *Anesthesia & Analgesia* 2013; 116:368-383. <http://www.ncbi.nlm.nih.gov/pubmed/23302983>
2. Karmarkar S, Varshney S. Tracheal Extubation. *Contin Educ Anaesth Crit Care Pain* 2008;8:7.
3. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, Cheney FW. Management of the Difficult Airway: A closed claims analysis. *Anesthesiology* 2005;103:33-9. <http://www.ncbi.nlm.nih.gov/pubmed/15983454>
4. Asai T, Koga K, Vaughan S. Respiratory complications associated with tracheal intubation and extubation. *British Journal Anesthesia* 1998;80:767-75. <http://www.ncbi.nlm.nih.gov/pubmed/9771306>

5. Faris K, Zayaruzny M, Spanakis S. Extubation of the Difficult Airway. *Journal of Intensive Care Medicine*;26(4) 261-266.  
[medind.nic.in/iadt/t06/i6/iadt06i6p430.pdf](http://medind.nic.in/iadt/t06/i6/iadt06i6p430.pdf)
6. King C, Moores L, Epstein S. Should Patients be able to Follow Commands Prior to Extubation? *Respiratory Care*; Jan 2010 (55) 56-65.  
<http://www.ncbi.nlm.nih.gov/pubmed/20040124>
7. Keenan MA, Stiles CM, Kaufman RL. Acquired laryngeal deviation associated with cervical spine disease in erosive polyarticular arthritis. Use of the fiberoptic bronchoscope in rheumatoid disease. *Anesthesiology* 1983;58:441-9.  
<http://www.ncbi.nlm.nih.gov/pubmed/6837996>
8. Khetarpal S, Martin L, Shanks AM, Tremper KK. Prediction and outcomes of impossible mask ventilation: a review of 50,000 anesthetics. *Anesthesiology* 2009; 110:891-7.  
<http://www.ncbi.nlm.nih.gov/pubmed/19293691>
9. Cook TM, Woodall N, Frerk C. Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: anaesthesia. *British Journal of Anaesthesia* 2011; 106: 617-310.  
<http://www.ncbi.nlm.nih.gov/pubmed/21447488>
10. Kuczkowski KM, Reisner LS, Benumof JL. Airway problems and new solutions for the obstetric patient. *Journal Clinical Anesthesia* 2003; 15:552-563.  
[http://www.jcafulltextonline.com/article/S0952-8180\(03\)00132-6/abstract](http://www.jcafulltextonline.com/article/S0952-8180(03)00132-6/abstract)
11. Sagi HC, Beutler W, Carroll E, Connolly PJ. Airway complications associated with surgery on the anterior cervical spine. *Spine* 2002; 27:949-953.  
<http://www.ncbi.nlm.nih.gov/pubmed/11979168>
12. Joshi G, Ahmad S, Riad W, Eckert S, Chung F. Selection of Obese Patients undergoing ambulatory surgery: A systematic review of the literature. *Anesthesia & Analgesia* Nov 2013; 117: 1082-1091.  
<http://www.ncbi.nlm.nih.gov/pubmed/24108263>
13. Fandino L, Tarazona N., Diaz J. Reflux laryngitis: an Otolaryngologist's perspective. *Rev Col Gastroenterol* [online]. 2011, vol.26, n.3, pp. 198-206.
14. Barash P, Cullen B, Stoelting R. *Clinical Anesthesia - 4<sup>th</sup> edition*. Page 614.
15. Newmark J, Ahn Y, Adams M, Bittner E, Wilcox S. Use of Video Laryngoscopy and Camera Phones to Communicate Progression of Laryngeal Edema in Assessing for Extubation: A Case Series. *Journal of Intensive Care Medicine* 2013; 28(1): 67-71.
16. Ochoa ME, Marin C, Frutos-Vivar F. Cuff-leak test for the diagnosis of upper airway obstruction in adults: a systemic review and meta-analysis. *Intensive Care Medicine* 2009; 35(7): 1171-1179.
17. Khamiees M, Raju P, DeGirolamo A, Amoateng-Adjepong Y, Manthous CA. Predictors of extubation outcome in patients who have successfully completed a spontaneous breathing trial. *Chest* 2001; 120: 1262-1270.
18. Wittekamp B, van Mook W, Tjan D, Zwaveling J. Clinical review: Post-extubation laryngeal edema and extubation failure in critically ill adult patients. *Critical Care* 2009; 13:233-242.
19. Wattenmaker I, Concepcion M, Hibberd P, Lipson S. Upper airway obstruction and perioperative management of the airway in patients managed with posterior operations on the cervical spine for rheumatoid arthritis. *J Bone Joint Surgery Am* 1994; 76: 360-365.
20. Burke CM, Walsh MT, Pryor SG, Kasperbauer JL. Severe postextubation laryngeal obstruction: the role of prior neck dissection and radiation. *Anesthesia and Analgesia* 2006; 102: 322-325.
21. Wegmuller B, Hug K, Meier Buenzli C, Yuen B, Maggiorini M, Rudiger A. Life-threatening laryngeal edema and hyponatremia during hysteroscopy. *Crit Care Res Pract* 2011; 2011: 140381.
22. Chassot PG, Marucci C, Delabays A, Spahn DR. Perioperative antiplatelet therapy. *AmFam Physician* 2010; 82:1484-1489.
23. Erdos G, Tzanova I. Perioperative anesthetic management of mediastinal masses in adults. *Eur J Anesthesiology* 2009; 26:627-632.
24. Murphy GS, Brull SJ. Residual neuromuscular block: lessons unlearned. Part I: definitions, incidence and adverse physiologic effects of residual neuromuscular block. *AnesthAnalg* 2010; 111: 120-128.