Difficult Intubation Resulting in Surgical Repair of Esophageal and Hypopharyngeal Perforation

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Although rare, perilous injury of the aerodigestive tract due to traumatic endotracheal intubation can have devastating consequences for patient and provider. Resulting serious complications of injury may involve esophageal perforation, pneumomediastinum, mediastinitis, retropharyngeal abscess, vocal cord paralysis, arytenoids dislocation, and hypopharyngeal pseudodiverticulum. Morbidity, mortality, and legal and financial consequences can be enormous. Early identification and treatment of suspected injury will promote patient recovery and thwart life-threatening progression of injury. This case report presents a 70-year-old woman scheduled for an elective hip arthroplasty. Intraoperatively she was unable to be intubated, and her operation was canceled. In the post-anesthesia care unit, the patient underwent an otolaryngology consultation and was admitted for observation of reactive airway edema. Pharyngoesophageal perforation was diagnosed several days later and required surgical repair.

Keywords: Esophageal perforation, difficult intubation, pneumomediastinum.

Difficult airway intubation may occur ubiquitously across healthcare and is reported to occur with an incidence of approximately 6% in anesthesia. Difficult intubation occurs when multiple laryngoscopies, maneuvers, and/or blades are used by an experienced practitioner. Trauma caused by multiple attempts at intubation can lead to perilous injury anywhere along the path traversed by the laryngoscopic blade and/or endotracheal tube. In fact, the rate of airway-related complications significantly increases as the number of laryngoscopic attempts increases, resulting in airway trauma and edema, which may ultimately create a critical airway event. Although pharyngoesophageal injuries due to endotracheal intubation are rare, it remains an underappreciated complication of tracheal intubation. Despite the diagnosis of perforation often being clinically evident in light of the history of difficult intubation, closed claims data suggest that prompt diagnosis of pharyngoesophageal perforation may be difficult; signs of perforation were absent in 50% of the cases reported where the intubation was believed by the anesthesia provider to be atraumatic. Therefore, the practitioner must remain vigilant in observing evolving signs or symptoms of perforation and in educating our patients when to seek care following discharge.

Early recognition of injuries resulting from instrumentation of the airway and placement of an endotracheal tube is essential. Hypopharyngeal injury due to endotracheal intubation can cause rare but serious complications and can have devastating effects for both the patient and provider. Morbidity and mortality are substantial when disruption of the esophagus occurs, even more so when not recognized early. Consequences of both legal and financial magnitude can be enormous, with payments for this type of injury significantly higher than all other airway injuries combined. In one closed claims analysis, difficult airway accounted for 17% (10 of 58) of all respiratory claims over a 4-year span. Seven of these 10 claims resulted in death, and of the remaining 3 patients, 2 (3.4%) experienced esophageal tears requiring surgical intervention.

This case report presents a difficult intubation and delayed identification of esophageal perforation following an inability to intubate a patient for an elective hip arthroplasty, and describes the resulting hospital course for mediastinitis and surgical repair of the injury.

Case Summary

A 70-year-old woman presented for a cervical exploration and possible esophagogastrectomy 4 days following operative cancelation for failure to intubate during a planned general anesthetic for an elective hip arthroplasty (Table 1).

A review of the notes from the previous anesthesia provider indicated preoperative airway classification as Mallampati 3, thyromental distance greater than 3 cm, normal dentition, and normal respiratory and cardiac findings. Absent from the previous airway notes were quantified attempts to secure the airway, indicated level of the provider for each attempt, size of endotracheal tubes attempted, whether a stylet was used during any attempt, and narrative of transpired events illuminating potential cause of difficulty. Anesthesia notes indicated a Certified Registered Nurse Anesthetist and physician configuration assigned to the case, 3 different devices used during multiple intubation attempts, several physi-
cians in the room, and 66 minutes of intraoperative activity recorded for the case.

Following emergence from anesthesia, the patient was admitted for observation because she complained of sore throat, hemoptysis, hoarseness, and dysphagia. An otolaryngology consult was obtained, and a nasal fiberoptic examination was performed; results noted generalized supraglottic edema, with both vocal cords moving well, but the otolaryngologist was unable to assess the arytenoid position because of swelling. Overnight observation was recommended for reactive airway edema. Diet was as tolerated, but the patient reported difficulty swallowing with oral intake. No additional testing was performed, and the patient was discharged from the observational stay on day 3. Approximately 12 hours later the patient presented to the emergency department because she was concerned about her inability to control her saliva or swallow blood pressure medication, and the possibility of evolving dehydration.

On the day of readmission, a chest radiograph and computed tomography (CT) scan were obtained and documented bilateral pneumothoraces, pneumomediastinum (Figure 1), and mediastinitis. White blood cell count was noted to be 17.72, and serum urea nitrogen was 45 mg/dL. A thoracic surgeon was consulted, and an esophagram and additional CT studies were ordered, which revealed a hypopharyngeal mucosal perforation at the level of C3-4, and an esophageal perforation at the level of T4-5 (Figures 2-6). The patient was transferred for specialty care and surgical intervention.

Consultation with patient records, thoracic surgery, and otolaryngology took place preoperatively for development of an airway management plan. The patient was interviewed and examined in the preoperative area, and consent was obtained for general anesthesia and the planned endotracheal intubation. Safety precautions were taken to ensure an escalating plan of care if failure to secure the airway occurred.

The patient was given 2 mg of midazolam en route to the operative suite. Electrocardiogram leads, pulse oximeter, and noninvasive blood pressure cuff were placed. Preoxygenation occurred, and anesthesia was induced with 50 mg of lidocaine, 150 mg of propofol, and 50 μg of fentanyl. Her ability to be ventilated was confirmed, and rocuronium (50 mg) was administered. A video laryngoscope (Storz C-MAC) was used as a first attempt to provide visualization of pharyngolaryngeal structures by the intraoperative surgical team. Observations of laryngoscopy were a small amount of unobscuring blood in the oropharynx and grade 1 vocal cord view. The left vocal cord was partially adducted, while the right vocal cord was completely abducted. A 7.0-mm endotracheal tube was inserted atraumatically, with confirmed end-tidal carbon dioxide and bilateral breath sounds.

Cervical exploration of the neck was performed, resulting in repair of a 2-cm laceration of the hypopharynx and a 1.5-cm laceration of the esophagus. Additionally, a gastrostomy tube was placed, through a minilaparotomy incision, for postoperative nutrition. Her hospital course consisted of 12 additional postsurgical days for resolution of the lacerations (Table 1). Gastrostomy tube feedings served as a nutrition source while she was in the hospital and following discharge to allow complete healing of the repaired defects.

### Discussion

Airway management is a fundamental aspect of anesthetic practice. Thus, anesthesia professionals are well versed in proper techniques of endotracheal tube placement and identification of potential barriers to successful placement, as well as expert in troubleshooting failed intubation attempts. Guidelines for difficult airway management are offered by such entities as the Difficult Airway Society (DAS) and American Society of Anesthesiologists (ASA). Both the ASA and DAS have devised widely adopted flowcharts to assist our decision-making process.

### Table 1. Case Report Timeline

<table>
<thead>
<tr>
<th>Stage of care</th>
<th>Day</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective hip arthroplasty</td>
<td>1</td>
<td>Surgical procedure canceled, unable to intubate. ENT consult. Complaint of hemoptysis, dysphagia, hoarseness. Overnight admission.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Observed. Diet as tolerated. Persistent dysphagia.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Discharge to home. ENT office visit. Persistent edema and complaint of dysphagia.</td>
</tr>
<tr>
<td>Admission and transfer</td>
<td>4</td>
<td>Patient presents to emergency department with complaint of dysphagia. Chest radiograph, CT, and esophagram reveal esophageal perforation, mediastinitis, and bilateral pneumothoraces. Thoracic surgery consult; patient acceptance of surgery.</td>
</tr>
<tr>
<td>Surgical intervention</td>
<td>5</td>
<td>Surgical repair of injury and care for resultant complications</td>
</tr>
<tr>
<td>and hospitalization</td>
<td>6-15</td>
<td>Ongoing care with specialty visits from medicine, thoracic, speech, nursing, dietetics, and ENT departments with repeated laboratory and radiologic studies and ongoing medication management of leukocytosis and mediastinitis</td>
</tr>
<tr>
<td>Discharge</td>
<td>16</td>
<td>Discharge with gastrostomy tube for temporary nutrition</td>
</tr>
</tbody>
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Abbreviation: CT, computed tomography; ENT, ear, nose, throat (otolaryngology).
Figure 1. Pneumothorax, Right Apical, and Pneumomediastinum

Figure 2. Mucosal Perforation (arrow) in Posterior Nasopharynx

Figure 3. Contrast Material Filling Pharyngeal Defect (arrow)
making process while minimizing risk of patient injury in dealing with identified or unplanned difficult airway encounters. Central to both algorithms is identifying and managing a “cannot mask ventilate; cannot intubate” scenario, maintaining oxygenation and ventilation, and decision making for adequate ventilation without successful intubation. In an adequate oxygenation and ventilation scenario, such as that presented in this case report, both algorithms recommend minimizing attempts quantitatively.3,14 Additionally, each algorithm suggests techniques for maximizing success to include planning, calling for help, modified positioning, blade change, external laryngeal manipulation, and use of supraglottic devices, to name a few, each with a termination point to awaken the patient or proceed to surgical airway (Table 2).

When a difficult intubation is encountered, it is recommended that comprehensive documentation of the event occur and that the patient be made aware of the difficulty.13 Suggestions for recording include the number of attempts, devices used, personnel attempting laryngoscopy, visual observations, and a description indicating the extent to which each of these techniques served a beneficial or detrimental role in management of the difficult airway (Table 3).13 The intent of this documentation is to guide and facilitate the delivery of future anesthesia care.13

Endotracheal intubation is commonly and safely performed worldwide and is rarely associated with major complications.7 However, despite training and thorough preparation, a rare complication of endotracheal intubation—hypopharyngeal or esophageal perforation—is possible.6,7 Although infrequent, iatrogenic injury of the hypopharynx and esophagus is a serious complication, which may lead to substantial morbidity and mortality. Anesthesia providers must be keenly aware of this potential injury, especially in concert with a difficult airway event, associated airway trauma, and/or pertinent patient complaints (Table 4).7,11,15

Figure 4. Mucosal Perforation at Level of Epiglottis and Cricoid Cartilage With Contrast Material Filling Defect

Figure 5. Extraluminal Contrast Material (arrowhead) Tracking Along Right Aspect of Esophagus From Thoracic Inlet

Figure 6. Esophogram, Gastrografin Pooling in Mediastinum Approximate Level T4-5
Most perforations associated with endotracheal intubation occur during emergent intubation, or difficult intubation, often performed by relatively inexperienced personnel (Table 4). In fact, inexperienced personnel are indicated in numerous articles as the primary contributing factor to esophageal perforation. In addition, improper patient positioning, blind or hasty intubation attempts, the use of curved endotracheal tubes or stylets, and poor muscle relaxation may contribute to airway perforation. Moreover, compared with other claims for airway injuries, patient factors were positively associated with pharyngoesophageal perforation: difficult intubation, age older than 60 years, and female gender (Table 4).

Airway perforation may occur anywhere from the nose to the trachea. As a result, air may enter unusual locations by dissecting along cervical fascial planes, manifesting as subcutaneous emphysema, pneumomediatinum, or pneumothorax. Therefore, early warning signs of perforation in the immediate postoperative period may include any of these findings with symptoms relatively nonspecific, including sore throat, deep cervical pain, chest pain, and cough (Table 4). In the presence of a difficult intubation and any of the above-mentioned complaints, early diagnostic intervention with a chest radiograph may be prudent (Figure 7). If the diagnosis is delayed, later symptoms of fever, dysphagia, and dyspnea evolve as bacterial invasion results in the delayed development of deep cervical or retropharyngeal abscess, mediastinitis, or pneumonia.

Perforation in any patient after a difficult intubation is a possibility and should be suspected in any case where difficult endotracheal intubation has occurred and any early warning signs are present (Table 3). If pharyngoesophageal injury is diagnosed or highly suspected, careful direct laryngoscopy, tracheobronchoscopy, and esophagoscopy are performed by the otolaryngologist. Neck exploration is considered if
the extent of the injury is beyond what can be evaluated by endoscopy and in more severe injuries, thoracotomy may be indicated.12

Conclusion
Pharyngoesophageal complications resulting from unintended effects of endotracheal intubation can be life-threatening. Poorest outcomes are associated when diagnosis and treatment were delayed, and mortality approaches 56% when indicated surgical treatment is delayed for greater than 12 hours in a symptomatic patient.12 Therefore, a high suspicion of injury in the presence of multiple intubation attempts and compromised vocal cord view, early chest radiography, and consultation with other healthcare professionals should occur expeditiously in an attempt to spare patients from deleterious sequelae of pharyngoesophageal perforation.

No patient is immune to the risks of intubation injury, and no one anesthesia professional is immune to the possibility of causing these injuries.12 However, by recognizing high-risk patients, and the early warning signs of an intubation injury, morbidity and mortality can be minimized. In addition, utilization of difficult airway algorithms such as those created by the ASA or DAS can remind us to minimize diagnostic laryngoscopic attempts, use techniques to optimize visualization of the glottic opening, defer to a more experienced practitioner, and integrate a supraglottic airway device as adjunctive support. Moreover, comprehensive documentation of a difficult airway encounter should occur to serve the patient’s future anesthesia care.

REFERENCES


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