Cardiothoracic Anesthesia, Respiration and Airway

Postoperative tracheal rupture in a patient with a difficult airway

[Rupture postopératoire de la trachée chez un patient difficile à intuber]

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Purpose: Tracheal rupture is an uncommon and potentially life-threatening event. This report presents a case of postoperative tracheal rupture in a patient with a known difficult airway presenting to a rural hospital.

Clinical features: A 29-yr-old man presented to a rural hospital with sudden onset neck pain and progressive dyspnea. Five days earlier the patient had undergone tracheal resection for tracheal stenosis related to prolonged intubation. The patient informed the emergency room staff that the attending anesthesiologist had made note of a "difficult airway". The community hospital had neither a portable storage unit for difficult airway management nor a bronchoscope available. In the presence of a general surgeon, an initial attempt at an awake intubation was unsuccessful. During this time the patient developed massive subcutaneous emphysema obliterating surgical landmarks and causing stridor. A modified rapid sequence intubation was performed. Intubation was successful using a Jackson-Wisconsin #3 straight blade and styletted endotracheal tube. The patient was transferred to a tertiary care centre where he underwent a primary repair of the trachea.

Conclusion: Management of tracheal rupture in the patient with a difficult airway is a challenging problem, especially, in a rural hospital. This case highlights the need for skilled staff and resources to manage a difficult airway in the emergency room.

Objectif: La rupture trachéale est un événement rare et potentiellement mortel. Nous présentons un cas de rupture trachéale postopératoire chez un patient, reconnu difficile à intuber, qui a consulté dans un hôpital rural.

Éléments cliniques : Un homme de 29 ans s'est présenté dans un hôpital rural pour une douleur au cou d'apparition soudaine et une dyspnée progressive. Cinq jours auparavant, il avait subi une résection trachéale pour une sténose reliée à une intubation prolongée. Le patient a mentionné au personnel de l'urgence que l'anesthésiologiste traitant avait consigné une «intubation difficile». L'hôpital communautaire n'avait pas de chariot mobile pour intubation difficile, ni de bronchoscope disponible. Le premier essai d'intubation vigile, en présence d'un chirurgien général, s'est révélé infructueux. Pendant ce temps, un emphysème massif sous-cutané s'est développé, oblitérant les repères chirurgicaux et causant un stridor. Une intubation à séquence rapide modifiée a été réalisée et réussie en utilisant une lame droite Jackson-Wisconsin n° 3 et un tube endotrachéal avec sonde endoluminale. Le patient a été transféré à un centre de soins tertiaires où il a subi une réparation primaire de la trachée.

Conclusion : Le traitement d'une rupture trachéale chez un patient difficile à intuber représente tout un défi, surtout dans un hôpital rural. Ce cas illustre la nécessité d'un personnel qualifié et de ressources pour traiter l'intubation difficile à l'urgence.

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TRACHEAL rupture is a life-threatening event requiring skilled emergency management. It has been reported in association with multiple causes, most commonly trauma and intubation.¹⁻⁸ Tracheal rupture may present with mediastinal emphysema, subcutaneous emphysema, pneumothorax and respiratory compromise. Prompt recognition of the problem and control of the airway below the level of the injury is imperative in these cases. Tracheal rupture may also present in an insidious manner with symptoms progressing over a period of hours to days.^{1,4,6} Emergency management of the patient with a difficult airway presents unique challenges. This report presents a unique case of post-tracheal resection tracheal rupture in a patient with a difficult airway who presented to a rural hospital with limited airway management resources.

Written consent for publication of this information was obtained from the patient, in accordance with local institutional guidelines.

Case report

A 29-yr-old male presented to a small community hospital emergency department with a 30-min history of sudden onset neck pain and progressive dyspnea. Five days prior to admission he had undergone tracheal surgery to repair a subglottic stenosis. The patient stated that he had been advised by the attending anesthesiologist that he had a "difficult airway". The patient was involved in a motor vehicle accident with complications requiring prolonged intubation one year prior to presentation to the emergency department. Subsequently he developed symptomatic tracheal stenosis.

Four months prior to presentation he had undergone flexible bronchoscopy with laser therapy to a stenotic area of the trachea 3 cm below the vocal cords. Anesthesia records indicated that a grade IV Cormack-Lehane⁵ laryngoscopic view was obtained with a MacIntosh #3 blade. The attending anesthesiologist was unable to intubate with a styletted endotracheal tube and intubation was accomplished with the aid of a fiberoptic bronchoscope. The endotracheal tube was positioned above the stenosis. The stenotic area was initially too small to allow passage of a 6-mm bronchoscope. Laser therapy was carried out and at the end of the procedure an 8.5 mm endotracheal tube was passed through the stenotic area. The patient was discharged without incident on postoperative day one.

Two months prior to presentation the patient again had laser ablation of the stenotic area of the trachea. This was accomplished by rigid bronchoscopy. The patient was managed by jet ventilation and his trachea

was not intubated. At the end of the procedure the rigid bronchoscope could be passed beyond the stenotic area. The patient continued to have exertional dyspnea and a tracheal resection with primary anastomosis was undertaken. Insertion of a rigid bronchoscope immediately before tracheal resection was noted to require the aid of a MacIntosh laryngoscope blade. Intubation after the rigid bronchoscopy required the aid of a gum elastic bougie. Following tracheal resection the patient was uneventfully extubated and his immediate postoperative course was uneventful. He was discharged on postoperative day three.

Initial examination in the emergency room revealed moderate bilateral cervical subcutaneous emphysema. Airway examination revealed moderate micrognathia, full teeth and a Mallampati II view of the pharynx. The patient was afebrile with oxygen saturation of 99% on room air. His heart rate was 108, blood pressure was 135/91 mmHg and he had a respiratory rate of 20 min⁻¹. Supplemental oxygen was provided via nasal prongs and the patient was transferred to the resuscitation room.

Unfortunately, the community hospital emergency department was not equipped with a 'difficult airway' setup and a fiberoptic bronchoscope was not available in the hospital. MacIntosh #3 and #4 blades and a Jackson-Wisconsin #3 blade were obtained from the operating room. With the general surgeon standing by for a potential surgical airway, topical airway anesthesia was obtained with 4% lidocaine. A single attempt was made at awake laryngoscopy and a Cormack-Lehane⁵ grade IV view was obtained. This attempt was made 35 min after initial hospital registration. By that time the patient had developed massive subcutaneous emphysema extending from the tragus to the nipples and he became stridulous secondary to tracheal compression. In addition to compression of the airway, the subcutaneous emphysema obliterated surgical landmarks.

In light of the patient's impending airway obstruction, a decision was made to proceed to a rapid sequence intubation. Anesthesia was induced with propofol 200 mg *iv* and the patient was paralyzed with succinylcholine 120 mg *iv*. Attempted intubation with the MacIntosh #3 blade revealed a grade IV Cormack-Lehane⁵ view. A second attempt was made with the Jackson-Wisconsin blade. A grade II laryngoscopic view was obtained and an 8.0 mm endotracheal tube was passed with the aid of a stylet. Correct position of the endotracheal tube was confirmed by the presence of bilateral breath sounds on auscultation and chest radiography. At no time did the patient become hypoxemic or hemodynamically unstable. Prior to and during transport, he was sedated and paralyzed in

order to reduce the risk of inadvertent endotracheal tube dislodgement. He was transferred to the regional tertiary care centre where he had a primary anastomosis of the tracheal rupture, which unfortunately, broke down necessitating a second repair. At that time a low tracheostomy was performed and repair of the trachea was again undertaken. This required an anterior commissurotomy and placement of a Montgomery keel stent to maintain vocal cord separation. He recovered uneventfully. The tracheotomy tube and stent were removed three months later.

Discussion

Tracheal rupture is an uncommon but potentially life threatening complication of intubation, trauma and head and neck surgery.¹⁻⁴ Late presentation of extrathoracic tracheal rupture or dehiscence following tracheal anastomosis is exceedingly rare and has not been reported previously. This complication presents a unique risk, as the patient may be out of hospital.

Tracheal rupture may present with mediastinal emphysema, subcutaneous emphysema, and pneumothorax.⁶ Stridor and hemoptysis may develop when the upper airway is involved.⁷ Rupture of the tracheobronchial tree may also present in a subtle manner with gradual progression of symptoms.^{1,3,4} In a historical review of the tracheobronchial injuries Kiser *et al.*¹ noted that patients presenting late had an increased survival, and this is likely due to the severity of associated injuries.

In patients with symptoms of respiratory distress rapid airway control is necessary.⁷⁻¹⁰ Management of the patient with an extrathoracic tracheal rupture was described by Devitt and Boulanger.⁷ They suggest that fiberoptic bronchoscopy should be the initial choice in intubating patients in whom the cervical spine is clear and airway obstruction is not imminent. This ensures that the endotracheal tube is placed beyond the tracheal disruption and avoids inadvertent mediastinal intubation.⁷⁻⁹ In this group of patients rigid bronchoscopy may also be a useful adjunct if available.⁷ Further, they suggest that tracheotomy should be the primary mode of securing the airway in the patient with impending airway obstruction.⁷ This would then be followed by endoscopy and surgical repair of the airway.

Desjardins and Varon⁸ have suggested that the airway management of patients with penetrating neck injuries be divided into three categories: emergent, urgent and elective, depending upon the injury and the patient status. They suggest that patients with penetrating neck injuries involving the airway requiring emergent intubation should be intubated via the orotracheal route with in-line immobilization of the

cervical spine. They also suggest that those patients requiring urgent or elective airway control be intubated with the aid of a fiberoptic bronchoscope.⁸

Management of the patient with a difficult airway has been outlined in the American Society of Anesthesiologists Difficult Airway algorithm.¹¹ The algorithm states that in addition to assessment of the airway and provision of supplemental oxygen one should consider the following dichotomies: 1) awake intubation *vs* intubation after induction of general anesthesia; 2) non-invasive *vs* invasive approach to intubation; 3) preservation *vs* ablation of spontaneous ventilation. Failed awake intubation is followed by consideration of other options or invasive surgical access. In the case of failed intubation after induction of general anesthesia, airway management relies initially upon supraglottic devices followed by invasive airway control.¹¹

This case involved two additional challenges in addition to tracheal disruption and known difficult airway. They were lack of dedicated difficult airway management tools and sudden onset of stridor with impending airway obstruction. Certainly awake intubation, preferably with a bronchoscope, was the technique of choice in this setting. However, awake laryngoscopy was the only awake intubation option as no bronchoscope was available. Failure of awake intubation is followed in the American Society of Anesthesiologists guidelines by invasive intubation.¹¹ The development of massive subcutaneous emphysema obliterated tracheal landmarks and resulted in stridor. Although a general surgeon was available, this patient posed a significant technical and temporal challenge. Consideration was given to an invasive airway, but careful review of patient status and available resources made this option untenable.

Finally, the management of this patient's airway required consideration of preservation *vs* ablation of spontaneous ventilation. Inhaled induction of anesthesia requires that the patient be in an operating room or that the anesthesia machine be transported to the emergency room. Given the rapidly changing nature of the patient's respiratory status, neither of these options was safe. Thus, the patient had an unsuccessful attempt at awake intubation, and was an unsuitable candidate for primary tracheotomy or inhaled induction of anesthesia. Further, supraglottic devices and bag valve mask ventilation were contraindicated as they may serve to increase the subcutaneous emphysema and increase the airway obstruction. Therefore, while the preferred method of airway control would have been an awake fiberoptic intubation, the lack of equipment and impending airway obstruction forced us to utilize a rapid sequence technique to secure the

airway. This was done with the additional challenge of a known difficult airway.

Overall management of the ruptured trachea can be divided into immediate and long-term strategies. Immediate management involves placement of an endotracheal tube with the cuff inflated distal to the tracheal rupture. As described, this is best accomplished with the aid of a fiberoptic bronchoscope to ensure correct positioning and avoid placement of the endotracheal tube through the disruption in the trachea.⁷⁻⁹ However, placement of the endotracheal tube should not be delayed if fiberoptic bronchoscopy is not immediately available. Translaryngeal intubation may be preferred over emergent tracheotomy as the subcutaneous emphysema may make tracheotomy difficult. Further, tracheotomy requires that the level of the tracheal disruption be known and above the level of the insertion of the tracheal tube.

Long-term management of tracheal rupture may be surgical or non-surgical.^{6,12-14} Gabor *et al.*⁶ suggest that short lacerations not involving the whole thickness of the trachea can safely be treated with antibiotics and intubation with the cuff inflated distal to the site of the tear. Madden *et al.*¹³ report the use of a tracheal stent to repair an iatrogenic tracheal tear. However, most patients will require surgical intervention for repair of the tracheal tear.^{1,6-10} In the case of this patient, two surgeries were required to create a stable anastomosis.

Of considerable importance in the management of this patient was the lack of appropriate resources for management of the difficult airway. The American Society of Anesthesiologists guidelines for the management of the difficult airway¹¹ outline a list of suggested contents of a portable storage unit for difficult airway management. While the specific contents of the portable storage unit are suggestions and should be tailored individually to meet the needs, skills and preferences of the institution, its presence should be strongly considered in institutional settings where airway management is practiced. Additionally, there should be available skilled practitioners familiar with the available airway management equipment, with a good working knowledge of the assessment and management of the difficult airway. Availability of such skilled personnel is particularly important in the rural hospital, as there may be limited backup resources.

In summary, a case of late dehiscence of a tracheal anastomosis in a patient with a difficult airway is reported. Management of the difficult airway in the setting of an extrathoracic rupture of the trachea is reviewed. This case highlights the need for emergency department personnel to be familiar with the principles of difficult

airway management. Further, it highlights the need for rural hospitals to have available an appropriate array of tools for management of difficult airway.

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