YALE JOURNAL OF BIOLOGY AND MEDICINE 84 (2011), pp.9-13.

CASE REPORT

Pretracheal Abscess Following Two Weeks of Endotracheal Intubation

Narayan Neupane[a*], M. Frances Schmidt[b], Neerja Gulati[c], Muhammad Perwaiz[d], Fadi Hammoudeh[a], Eneh Kennedy[a], Mehjabin Zahir[a], Danilo Enriquez[e], and Joseph Quist[f]

[a]Pulmonary fellow; [b]Program Director, Department of Pulmonary Medicine; [c]Medical Resident; [d]Chief Resident, Department of Medicine; [e]Associate Program Director, Department of Pulmonary Medicine; [f]Director Of Critical Care, Interfaith Medical Center, Brooklyn, New York

Pretracheal abscess due to endotracheal intubation has not been reported in literature. We present a case of a female patient who was admitted with acute hypercapnic respiratory failure. Patient was initially managed with noninvasive ventilation but eventually was intubated after sustaining a cardiac arrest. She could not be extubated because of poor weaning parameters, so a tracheostomy was planned. During surgery, a pretracheal abscess was found with destruction of the second, third, and fourth tracheal rings and intact posterior tracheal wall. The possible risk factors, mechanism of injury, and preventive strategy of tracheal complication of intubation are discussed.

INTRODUCTION

Complications of prolonged endotracheal intubation are sore throat, laryngeal edema, mucosal ulceration, laryngeal stenosis, tracheal stenosis, cuff trachiectasis, tracheal-innominate artery fistula, and tracheoesophageal fistula. One case report of a pretracheal abscess was reported following retrograde tracheal intubation, but it is not reported as a complication of orotracheal or nasotracheal intubation [1]. We present a case of an incidental operative finding of a pretracheal abscess discovered at tracheostomy following two weeks of endotracheal intubation.

CASE REPORT

A 67-year-old woman with a medical history of obstructive sleep apnea, obesity hypoventilation syndrome (height 5 ft 8 in, body mass index 39.2), Cor pulmonale, coronary artery disease (coronary artery bypass surgery 18 years prior), diabetes

*To whom all correspondence should be addressed: Narayan Neupane, MD, Department of Pulmonary Medicine, Interfaith Medical Center, 1545 Atlantic Avenue, Brooklyn, NY, 11213; Tele: 718-613-4063; E-mail: nneupane@interfaithmedical.com.

†Abbreviations: MRSA, methicillin-resistant *Staphylococcus aureus*

Keywords: pretracheal abscess, endotracheal intubation

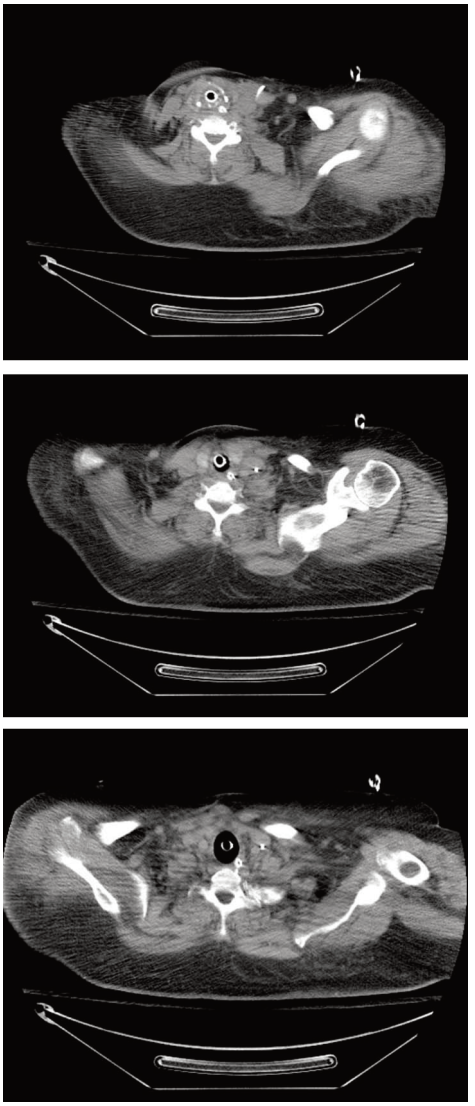

Figure 1. Neck CT scan at three different levels showing the endotracheal tube in the trachea and normal pretracheal and paratracheal space.

mellitus, and hypertension was admitted to the hospital with the diagnosis of acute hypercapnic respiratory failure. She was treated with noninvasive ventilation, oxygen, bronchodilators, diuretics, steroids, and antibiotics. She had marked right ventricular dilatation, high pulmonary artery pressure of 67 mm Hg, and normal left ventricular function on echocardiography. Patient improved initially and was maintained on bilevel positive airway pressure for hypercapnia. Patient suffered sudden cardiac arrest on the 14th day of hospitalization and was revived after 20 minutes of resuscitation. No precipitating factor was identified for the cardiac arrest. The intubation was done by an anesthesiologist without any complication, and patient was placed on mechanical ventilation with pressure regulated volume control mode. Prior to intubation, no mass was felt during the neck exam and patient never complained of any hoarseness, dysphonia, dysphagia, or any other symptom suggestive of an abscess in the neck. A CT scan of the chest was done 6 days after intubation (7 days prior to tracheostomy) to evaluate lungs. It did not show any evidence of abscess in the pretracheal area as shown in Figure 1. She was hemodynamically unstable and on pressor support for approximately 96 hours. She could not be extubated because of poor weaning parameters, including apneic episodes. A tracheostomy was planned because of failed extubation attempts.

Physical examination prior to tracheostomy revealed an afebrile patient with no swelling, erythema, or local elevation of temperature of the anterior neck. Laboratory tests before surgery showed leucocytosis, normochromic normocytic anemia, normal electrolytes, and normal renal and liver function. At the time of tracheostomy, after skin incision, the endotracheal tube was visualized in a pocket of pus with destruction of the second, third, and fourth tracheal rings. The anterior circumference of the trachea was necrotic with preservation of the posterior wall. The abscess was drained by placing the drainage tube in the abscess cavity and inserting a long tracheostomy tube. Bronchoscopy showed significant tracheomalacia but no trachea-esophageal fistula. A small air leak was noted the next day; there was no subcutaneous emphysema. Two different sets of blood culture taken 3 days apart were negative; however, lower respiratory and pus cultures from the pretracheal abscess grew methicillin-resistant *Staphylococcus aureus* (MRSA†). Patient was treated with intravenous linezolid and doripenem. Patient died of sepsis on post-op day 6, likely due to pneumonia.

DISCUSSION

The incidence of pretracheal abscess following endotracheal intubation is unknown, and it is not reported in the literature. This is the first case report of pretracheal abscess following endotracheal intubation. The significance of pretracheal abscess is enormous, because it may spread rapidly down to mediastinum through the contiguous fascial plane, leading to mediastinitis, which can be life threatening. If the abscess cavity involves the long segment of trachea, controlling the airway could be a problem even with a long tracheostomy tube. An air leak around the abscess can lead to subcutaneous emphysema, pneumomediastinum, and pneumothorax.

The complications of endotracheal intubation may occur during the events of intubation itself and as complications related to cuffed endotracheal tube in the airways. The incidence of tracheal injury during intubation is approximately 0.005 percent when a single lumen tube is used and ranges from 0.05 to 0.19 percent when a double lumen tube is used [2]. Predominantly, it occurs in the distal third of the trachea and main bronchi at the junction of membranous and cartilaginous portions. The most common clinical manifestations are subcutaneous emphysema in the chest and neck, pneumomediastinum, pneumothorax, and respiratory failure. The diagnosis is confirmed by fiberoptic bronchoscopy. Treatment is either surgical or conservative, depending on the extent of injury. Surgery is done for an extensive lesion in the distal trachea and when the respiratory isolation of the lesion is difficult [2].

In retrograde intubation, a guide wire is inserted via a needle through the cricothyroid membrane and the endotracheal tube is placed over the guide wire. The likely cause of pretracheal abscess in this type of intubation is a direct tissue injury by the needle and/or the guide wire with possible contamination of the pretracheal space, either from the skin or upper airways. Unlike the retrograde intubation, the injury in orotracheal intubation is usually indirect and multifactorial.

The incidence of complications of endotracheal intubation is common. The complications that are directly attributable to the presence of an endotracheal tube in the airways most commonly occur around the cuff and mostly at distal third of the trachea 2 to 3 cm above the carina but can occur anywhere in the trachea. Many factors contribute to the tracheal injury, including high endotracheal cuff pressure, larger tube size, systemic hypotension, respiratory infections, presence of nasogatric tube, and patient agitation. The pressure necrosis is the primary cause of trachea injury around the cuff. The impairment of tracheal mucosal blood flow due to the high pressure cuff and systemic hypotension plays an important role in tracheal injury [3]. Hypotension predisposes to tracheal necrosis, presumably by decreasing capillary perfusion around the endotracheal balloon cuff. Patient agitation also plays a role. The amount and location of lateral wall pressure exerted by the cuff may change with head position. Flexion of the head causes more pressure on the anterior wall of the trachea, while extension of the head results in more pressure to the posterior wall [4]. The severity of tracheal injury increases with the duration of intubation. Early changes are superficial tracheitis with fibrin deposits in tracheal mucosa around the cuff, which may involve the distal trachea as far as the carina. These changes are followed by small, shallow ulcers on the mucosa of the anterior portion of the trachea, the size and extent of which increase as the duration of intubation increases. Softening, splitting, and fragmentation of tracheal cartilages occur, leading to cuff site trachea devoid of cartilage and becoming completely flexible and collapsible [5]. Severe damage to compliant membranous portions of the trachea is less common at the site of balloon. Damage at the level of the tip of the endotracheal tube is considerably less and non circumferential compared to the damage around the cuff. The damaged trachea is more susceptible to infection originating from blood or local infected respiratory secretion. The seeding of organisms in injured and ischemic tracheal tissue might predispose to

the development of an abscess if the infection is not controlled.

At our institution, we use a high volume, low pressure cuffed endotracheal tube. The patient was intubated with No. 8 endotracheal tube (Hi-Lo®, manufactured by Mallinckrodt Company). A portable chest radiograph usually is performed soon after intubation and on a daily basis to assess the position of distal tip of the endotracheal tube. We prefer to maintain the position of the distal tip of the endotracheal tube at 2 to 6 cm above the carina. Tape is used to secure the endotracheal tube in position in most cases (including described patient). A commercial tube holder is used only on physician discretion/request. A respiratory therapist checks the endotracheal tube cuff pressure each morning to maintain it between 20 to 30 cm H_2O. Tracheal suction is done, using a closed suctioning system. The frequency of suctioning depends on the amount of secretions.

Our patient has many of the risk factors for tracheal injury, including prolonged mechanical ventilation, cuffed endotracheal tube, systemic hypotension, and respiratory infection. The proximal tracheal injury (tracheal rings 2, 3, and 4) in our patient does not correlate with the injury due to cuff position, which usually occurs in the middle and distal part of the trachea. Several mechanisms might have accounted for the tracheal injury in our patient. The injury could have been due to abrasive force on tracheal mucosa secondary to the movement of the inflated cuff when it was not well secured or weighed down by ventilator equipment. These forces might have been exaggerated when the patient became restless or struggled against the ventilator. Intermittent movements of the endotracheal tube with lodgment of the cuff in the proximal tracheal associated with patient movements during routine medical care also might have been responsible. The direct injury of the proximal trachea also might have occurred at the time of intubation with stylet and involving the anterior wall, owing to the obliquity of the trachea. This injury might be the nidus of infection, leading to abscess formation. Regardless of the mechanism, the pretracheal abscess in our patient was secondary to some kind of tracheal injury at the proximal level, which was exacerbated by hypotension and local infection leading to ulcerations and, finally, fragmentation and dissolution of the cartilaginous rings.

The symptoms and signs of ongoing tracheal damage are usually minimal; the inability to maintain an adequate seal with the cuff is the most common sign [6]. Because of an absence of local and systemic signs of infection, pretracheal abscess was never thought of in our patient. The reason for absence of local and systemic signs of infection could be due to various reasons. Our patient was moderately obese with a BMI of 39.2, and a small swelling in her neck might not have been apparent on clinical examination. She was intubated and sedated so she could not express any pain or discomfort in the neck. Furthermore, the use of systemic antibiotic for other suspected infections might have obscured the clinical picture and helped the immune system to contain the abscess without many local signs. As only a limited segment of the trachea was involved, tracheostomy was possible. Though there was an air leak the next day without another complication of air leak, it responded well to the extended tracheostomy tube.

Reduction of risk factors is of paramount importance to decrease the complications of the endotracheal tube. Every attempt should be made to shorten the duration of intubation. Daily cuff pressure monitoring aiming to keep pressure less than 30 cm H_2O, improvement of hemodynamic parameters, proper treatment of infection, adequate sedation, and avoiding unnecessary movement of the endotracheal tube may help to reduce it [3]. Tracheal abscess is a very rare complication of endotracheal intubation and is probably multifactorial. Physicians should be aware of this possible but rare complication. Physicians should have a lower threshold of imaging the trachea in intubated patients who fail weaning for unclear reasons or who remain septic with no identifying source of their sepsis.

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