Tracheal Perforation*  
A Complication Associated with Transtracheal Oxygen Therapy  
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A 73-year-old woman with a transtracheal oxygen catheter in place developed sudden onset of respiratory distress and subcutaneous emphysema. Bronchoscopy revealed the presence of three posterior tracheal wall perforations and a blind pouch arising from one of the perforations. Subsequent bronchoscopies revealed complete healing of the perforations. We believe that these perforations occurred during placement of the transtracheal catheter.  

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TTOT = transtracheal oxygen therapy  

The use of a transtracheal catheter for the delivery of oxygen to patients with hypoxemic respiratory disease is becoming more widely used.1,2 The use of this catheter appears to be a feasible and pleasing alternative to the use of a nasal cannula. While complications with its use have been described as minor and infrequent, there is a growing body of information describing significant associated morbidity.2,3 We describe a previously unreported complication of transtracheal oxygen therapy (TTOT)—perforation of the posterior wall of the trachea.  

CASE REPORT  

A 73-year-old woman had a 4-year history of dyspnea secondary to biopsy specimen-proven interstitial pulmonary fibrosis. Oxygen was administered on a continuous basis beginning 3 years after diagnosis, but due to her noncompliance with the nasal cannula, a transtracheal catheter was inserted at an outlying institution. No prednisone was administered over the year previous to the transtracheal catheter insertion. A stent followed by a catheter (SCOOP 1) was inserted as per a previously described protocol.1 Oxygen was initiated 2 weeks later at a flow rate of 4 L/min being administered via the SCOOP catheter setup. One week later, she was found to be in acute respiratory distress. The catheter was noted to be dislodged and massive subcutaneous emphysema of the face, neck, and chest were observed. The catheter was reinserted directly into the tracheal stoma without the use of a guidewire and without difficulty. The patient was immediately transferred to our facility. A chest radiograph revealed subcutaneous emphysema, a right-sided pneumothorax, and pneumomediastinum (Fig 1). Flexible, fiberoptic bronchoscopy (FOB) revealed a small amount of granulation tissue over the anterior tracheal wall at the catheter insertion site, two small perforations of the posterior tracheal wall 3 cm distal to the catheter insertion site, and a single larger perforation immediately proximal to the other two perforations. A blind pouch was demonstrated by injection of 3 ml of Dionosil into the larger of the three openings (Fig 2). No mediastinal extravasation of the contrast was noted. The patient improved with antibiotic therapy. Repeated FOB, performed 3 and 6 months later, revealed progressive, complete healing of each posterior tracheal wall lesion.  

DISCUSSION  

We describe a unique complication of TTOT that was associated with significant morbidity. Several types of cath-

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FIGURE 1. A chest radiograph taken following reinsertion showing bilateral subcutaneous emphysema.  

FIGURE 2. A radiograph demonstrating a pouch outlined by injection of Dionosil into one of the posterior tracheal wall defects.
placement procedure in which the stent is exchanged for the functioning SCOOP catheter. Since the insertion tract is not yet mature, it may easily be lost should the catheter become dislodged. Accidental displacement of the catheter typically occurs at night.

In our patient, the catheter became dislodged during the night and was associated with severe respiratory distress likely secondary to hypoxemia and severe subcutaneous emphysema. The cause of the subcutaneous emphysema may have been due to displacement of the catheter into the subcutaneous tissues or, more likely, into one of the tracheal perforations. We believe that these posterior tracheal wall lesions and blind pouch were a result of perforation of the tracheal mucosa occurring during the initial phase of stent placement. The exact timing of the perforation is uncertain, however. Other potential causes for the formation of the tracheal lesions include tracheal perforation following catheter reinsertion but the only reinsertion performed was the one done several hours prior to the initial bronchoscopy. It seems unlikely that the lesions were caused at that time as the catheter was inserted without difficulty then. Another potential process for the formation of the perforations may have been induced by a jet effect due to the oxygen flow through the catheter onto the posterior tracheal wall. Finally, it is possible that these perforations were congenital (eg, a cyst or a gland), but this cause is doubtful as complete healing of the tracheal wall was observed 6 months later.

The benefits of continuous oxygen therapy (eg, improvement in survival, pulmonary hypertension, and quality of life) in the patient with hypoxic chronic obstructive disease have been well demonstrated. The mode of administration of oxygen remains somewhat problematic. Oxygen is administered most commonly by a nasal cannula, but this modality may be associated with discomfort, inconvenience, epistaxis, and cosmetic embarrassment.

TTTOT being more widely used and is believed to be relatively safe. With the increase in use of TTTOT, more significant complications are being reported, ranging from relatively minor (eg, "mucus ball" formation, hemoptysis, hoarseness, bronchospasm, keloid formation, and cephalad catheter displacement) to more serious (eg, subcutaneous emphysema, respiratory tract infections, pneumomediastinum, cellulitis, and granulation tissue formation). Herein we have described another potential complication of TTTOT. Bronchoscopic evaluation of selected patients, as in this case, may be of value in further defining such potential complications.

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**Recurrent Massive Bleeding from an Intercostal Artery Aneurysm Through an Empyema Chest Tube**

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Intercostal artery aneurysms can be of congenital, post-traumatic, or mycotic type. Intercostal arterial aneurysmal bleeding can be brisk enough to lead into shock or sudden death. Bleeding through chest tubes has been reported due to various causes; it is commonly due to injury to intercostal or pulmonary vessels and is occasionally due to leaking aortic aneurysms. We describe a patient who had development of repeated episodes of brisk bleeding through an empyema chest tube leading to shock episodes requiring resuscitations. After extensive search, the bleeding source was found to be an intercostal artery aneurysm. Transcatheter embolization of that intercostal artery with absorbable gelatin sponge (Gelfoam) was successful in obliterating the blood flow to the aneurysm and in preventing further bleeding.

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There are various causes for bleeding through a chest tube; usually the source of bleeding is from intercostal vessels, pulmonary vessels, or the aorta. Although chest trauma is the common cause for bleeding into the pleural space, spontaneous hemotorax due to bleeding from intercostal arterial sources leading to shock episodes or even sudden death has been reported. We present the case of a 37-year-old man who was admitted to the medical ICU with bilateral pneumonia, empyema, and respiratory failure; he had development of the first episode of massive bleeding through the chest tube after the 48th day of chest tube placement. He went into hypovolemic shock and required massive blood and fluid transfusions. While he was being worked up for the bleeding source, he bled massively through the chest tube on two occasions; each time he went into profound shock and required massive transfusions and resuscitation. After extensive diagnostic studies, the bleeding source was identified to be an aneurysm of the tenth intercostal artery. Transcatheter embolization of that artery with absorbable gelatin sponge (Gelfoam) obliterated the

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