Airway obstruction by granulation tissue within a fenestrated tracheotomy tube: Case report

Michael A. Carron, MD; Sihun Alex Kim, MD; Raja Sawhney, MFA; Patrick Reidy, MD

Abstract
Complications of tracheotomy tube placement can be categorized as intraoperative, early postoperative, and late postoperative. Among the late complications is the development of granulation tissue. We describe one of the few reported cases of granulation tissue that formed within a fenestrated tracheotomy tube. In this case, the granulation tissue grew through the fenestrations, obliterated the tracheal lumen, and tethered the tube to the trachea itself. As a result, the patient required emergency treatment to restore airway patency.

Introduction
Historically, tracheotomy is considered to be one of the most ancient surgical procedures. Tracheotomies were being performed to save lives as early as 2000 B.C. In the early 20th century, Chevalier Jackson became the first to describe the procedure in detail and to delineate its complications.1

The advent of mechanical ventilation expanded the indications for tracheotomy to include maintenance of the airway for chronic mechanical ventilation. Kirchner summarized the purposes of tracheotomy as a means to “bypass obstruction in the supralaryngeal or laryngeal airway, to provide access to the lower respiratory tract to clear it by suction or to provide mechanically assisted ventilation.”2

The literature is replete with reports of complications associated with standard tracheotomy tubes, but there is little information regarding the complications associated with fenestrated tubes, especially granulation tissue. Four such cases were described in 1985 by Siddharth and Mazzarella.3 We describe a new case of granulation tissue in a fenestrated tracheotomy tube that was characterized by an episode of acute life-threatening airway obstruction and tethering of the tube to the trachea.

Case report
An airway emergency was declared for a 46-year-old woman who had been transferred from a long-term care facility. She had undergone tracheotomy tube placement 9 months earlier for respiratory failure secondary to extreme restrictive lung disease.

At the bedside, a single-lumen, cuffed, 8.0 fenestrated Portex tracheotomy tube was in place; the tube had two parallel fenestrations in its elbow (Figure 1). Nursing staff reported that suction catheters could not be passed and the patient could not be ventilated through the tube, so oxygen saturation just above 80% was maintained with face mask ventilation. A flexible fiberoptic laryngoscope was passed into the tracheotomy tube, and granulation tissue was seen obliterating its lumen. Attempts at decannulation failed, and it became apparent that the tube itself had become tethered to the trachea. Upon reexamination, two large...
posterior ingrowths of granulation tissue were seen protruding through the fenestrations (Figure 2). As the tube was retracted, a scalpel was used to incise the granulation tissue on the outside of the tube, thereby releasing it from the lumen of the trachea. A 6 DCT, cuffed Shiley tube was then placed into the airway without difficulty. The patient's oxygen saturation normalized, and she was transferred to the medical intensive care unit for further care.

Discussion

Reported rates of tracheotomy complications vary widely, ranging from 6.7% to 66%. 1,3 Complication rates for emergency tracheotomy in less-controlled and sterile conditions are 2 to 5 times higher than those for elective tracheotomy. 4 Complications can be classified as intraoperative, early postoperative, and late postoperative:

- Intraoperative complications include hemorrhage, tracheoesophageal fistula, tracheotomy tube obstruction, aggravation of unrecognized fracture, and dislocation of cervical vertebrae. 2
- Complications encountered during the early postoperative period include bleeding, pneumothorax, pneumomediastinum, subcutaneous emphysema, wound dehiscence, apnea with hypotension, and false passage. 1,2
- Later complications include major arterial hemorrhage, tracheoesophageal fistula, tracheotomy tube obstruction or displacement, infection, granulation tissue formation, and difficult decannulation. 1,4

Owing to advances in critical care and an increase in the number of patients undergoing long-term ventilation, the incidence of late complications is rising. Granulation tissue can be found peristomally, suprastomally, and in the tracheal lumen at the tip of the tracheotomy tube. Granulation tissue has been implicated in bleeding, tube obstruction, tube dislodgement, and difficulty in tube replacement. Frequent movement of the tube at the site of the stoma or in the tracheal lumen can lead to not only the development of granulation tissue but chronic ulceration and inflammation, as well.

Fenestrated tubes are sometimes used with the hope of weaning patients off a standard tracheotomy tube. By allowing for airflow via the larynx, fenestrated tubes help patients regain their protective reflexes and vocalization. 5 However, the placement of a fenestrated tube creates an environment conducive to irritation of the tracheal mucosa at sites near the fenestrations. The irritation promotes the formation and continued growth of granulation tissue through the fenestrations and into the lumen of the tube. This can result in obstruction of the lumen and tethering of the tube to the trachea itself. 3 As seen in our patient, this complication can be serious and even life-threatening.

Although obstruction and tethering of a fenestrated tracheotomy tube is rare (during an extensive review of the literature, we found only one article that specifically described granulation tissue obstruction of a fenestrated tracheotomy tube), this risk outweighs any benefit that a fenestrated tube may confer in terms of early weaning, decannulation, and voice usage. Therefore, fenestrated tubes must be used with extreme caution.

References