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Breathe Easy: Safe Tracheostomy Management

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The Case

A 75-year-old man was admitted to the hospital with sepsis due to multilobar pneumonia. He rapidly developed acute respiratory failure with evidence of acute respiratory distress syndrome that required mechanical ventilation. The patient improved with initial treatments but on hospital day 12, a decision was made to place a tracheostomy given the anticipated need for a prolonged respiratory recovery period. The patient reported feeling more comfortable after the tracheostomy than he felt with the endotracheal tube.

A few days later, the patient became increasingly agitated due to delirium. He developed acute hypoxia and respiratory distress when it was noted that his tracheostomy was dislodged. The critical care physician on call was notified and he tried to reinsert the tracheostomy tube. Multiple unsuccessful attempts were made and the patient ultimately went into cardiac arrest. The code team arrived and placed an endotracheal tube to secure the airway, which allowed successful resuscitation of the patient. The patient improved once again, had his tracheostomy replaced, and was eventually discharged to an acute rehabilitation facility for continued recovery.

The Commentary

by Matthew S. Russell, MD, and Marika D. Russell, MD

This case describes a rare, but manageable, complication of tracheostomy. One should be mindful that intubation by mouth is often the safest means of re-establishing an airway after tracheostomy dislodgement, particularly for providers who are not facile with placing a tracheostomy device. Fortunately in the case presented, this recommended practice was ultimately followed to avert further patient harm. However, the case does provide an opportunity to review the indications, management, and primary complications of tracheostomy.

Indications

Prolonged respiratory failure is the most common indication for tracheostomy in the United States.(1,2) The purported benefits of tracheostomy include enhanced weaning off the ventilator, improved pulmonary hygiene, greater patient comfort, facilitation of speech and swallowing, and earlier transition out of the intensive care unit.(3) Relative contraindications to tracheostomy placement include an existing coagulopathy, a high level of dependence on the ventilator (e.g., PEEP [positive end-expiratory pressure] greater than 16 cm H_2O, FiO_2 [fraction of inspired oxygen] greater than 0.60), and a high-riding innominate artery (owing to its proximity to the procedure location). It's also important to recognize that goals of care discussions frequently occur contemporaneously with the decision for tracheostomy, especially in cases where the decision to place a tracheostomy implies the need for prolonged mechanical ventilation due to poor clinical prognosis.(4) This approach is contrasted with clinical situations where patients require prolonged tracheostomy use and the benefits are for airway protection rather than mechanical ventilation (e.g., head and neck cancers causing airway obstruction).

There is not consensus on the ideal timing of tracheostomy placement in prolonged ventilator dependence. Tracheostomy should be considered around 14 days of intubation in an adult population to avoid laryngotracheal injury from prolonged intubation.(5) Some authors promote early tracheostomy (for patients with more than 4 days of intubation) to reduce sedation requirements, ventilator-associated pneumonia, and length of stay (6,7), though this remains controversial and cannot be considered standard of care.(8,9)

Finally, tracheostomy may be performed via an open surgical approach or by percutaneous dilatational technique. Factors that determine the approach are beyond the scope of this review, but with appropriate patient selection, both are safe procedures.(10)

Management

Tracheostomy care is an interdisciplinary effort. Physicians, nurses, respiratory therapists, speech language pathologists, and family caregivers all play a crucial role in post-tracheostomy care. Each institution should develop and maintain policies and procedures to define and standardize tracheostomy care.(11,12)

Care and maintenance of a tracheostomy involves routine cleaning of the device and surrounding skin, regular suctioning of secretions, inner cannula maintenance, and oral care. Tracheostomy devices can cause pressure ulcers, particularly along the inferior aspect of the tracheostomy faceplate. Standardized processes for skin care, including removing sutures at 5–7 days and placement of a skin-barrier dressing under the tracheostomy faceplate, can reduce the incidence of tracheostomy-related pressure ulcers.

The tracheostomy device should also be changed at regular intervals. The first change is typically performed by the proceduralist. Tracheostomy changes are relatively safe when accomplished by trained providers. All tracheostomy changes within 5 days of insertion should be performed with surgical equipment available, as the stoma is not yet well formed.

For many patients, a tracheostomy doesn't preclude the ability to communicate. Tracheostomy speaking valves are one-way valves placed on the tracheostomy tube connector. The valve opens during inspiration and closes during exhalation. During the expiratory phase, airflow is redirected to the upper airway, passing through the larynx, allowing for phonation. Anecdotally, tracheostomy speaking valves can improve quality

of life by restoring verbal communication. However, not all tracheostomy patients are candidates for speaking valve use. These valves may only be used in patients with patent upper airways. Placement of a tracheostomy speaking valve in a patient who is unable to pass air around the tracheostomy tube (i.e., inflated cuff or upper airway obstruction) may result in asphyxiation and death. Candidacy for speaking valve use should be determined through an evaluation by the proceduralist or speech-language pathologist.

Although some patients have lifelong tracheostomies, many can have their tracheostomy weaned as their underlying condition improves. Steps for tracheostomy wean include: i) wean from positive pressure ventilation, ii) demonstrate that the patient can tolerate cuff deflation, iii) perform sequential downsizing of tracheostomy tube, and iv) perform a capping trial. Cuff deflation requires restoration of airway protection and cough reflexes. Sequential downsizing to smaller tubes may follow as tolerated. With a small, cuffless tube in place, a capping trial can be performed, whereby the inner cannula is replaced with a plug. If the cap is tolerated for at least one wake–sleep cycle (approximately 24 hours), the tracheostomy is removed (decannulation) and the wound closes by secondary intention. An occlusive dressing is placed to prevent air escape during wound healing. The weaning process may be managed by trained providers, including physicians and respiratory therapists, in the rehabilitation setting.

Complications

Tracheostomy-related complications are uncommon (3.2% in a recent analysis of the National Inpatient Sample).(13) Most complications carry low morbidity, including minor bleeding, crepitus, cellulitis, and granulation. Major complications occur in less than 1% of patients and include major hemorrhage, airway obstruction, accidental decannulation, pneumothorax, tracheal stenosis, and tracheo-esophageal fistula. Although inpatient mortality is high in this cohort (20%) it is generally from the underlying disease. Tracheostomy-specific mortality is rare (0.4%).

Most bleeding after tracheostomy is manageable with topical hemostatic agents. Rarely, prolonged tracheostomy can lead to erosion of the anterior tracheal wall adjacent to the innominate artery and cause life-threatening hemorrhage from tracheo-innominate fistula (TIF). TIF may be preceded by a sentinel bleed, with the patient presenting with brisk peristomal bleeding. Such bleeding mandates evaluation by the proceduralist to rule out TIF.

Accidental decannulation may occur in the early or late postoperative period. Signs of this complication include: gross device dislodgement, airway obstruction not relieved by suctioning or inner cannula replacement, or inability to pass a flexible suction catheter. Presentation may be subtle in a stable patient. During the first 5–7 days after tracheostomy, before the stoma is well formed, dislodgement of the tube carries a greater risk of erroneous replacement into the paratracheal soft tissues and mediastinum (false passage). Until maturation, the tracheostomy tube should be secured by sutures and collar ties; torque on the device should be minimized.(2) It's unclear in our case what the root cause of the dislodgement was, but it is possible that the initial attempts to replace the tracheostomy were directed into a false passage.

Replacement of a dislodged tracheostomy tube should be accomplished by a trained provider with appropriate lighting and visualization to prevent a false passage. Standard airway management, including mask ventilation and trans-oral intubation, should be undertaken in cases of respiratory distress, except in

cases of glottic obstruction, severe subglottic stenosis, or in patients following laryngectomy.(14)

Pneumothorax is another uncommon early postoperative complication of tracheostomy (0.26%).(1) Breath sounds should be auscultated in any patient with respiratory distress following tracheostomy. Chest radiograph is prudent if respiratory distress and asymmetric breath sounds are present.

Tracheo-esophageal fistula (TEF) occurs in approximately 1 in 1250 patients following tracheostomy.(1) This complication results from posterior tracheal wall erosion. The hallmark of TEF is an air-leak despite a functional, fully inflated cuff. This complication may lead to aspiration and pneumonia, and these complications should prompt the clinician to rule out TEF.

Finally, laryngotracheal stenosis occurs in approximately 1.7% of patients following tracheostomy, though many of these cases may be related to preceding intubation, particularly with a large (more than 7.5 mm) endotracheal tube.(2)

Creating Safe Systems

Tracheostomy management is largely based on clinical algorithms and lends itself well to standardized care pathways. While many aspects of tracheostomy care are not evidence based, practice variability within a health care system may lead to communication breakdown and inefficient or unsafe care. It is therefore incumbent upon health care systems to develop standardized care pathways that facilitate coordinated and safe care. Our anecdotal experience suggests that implementation of standardized protocols minimizes confusion among the multiple services who provide tracheostomy care and allows for safe and streamlined delivery of care.

Take-Home Points

- Tracheostomy is a safe and beneficial tool in critically ill patients when managed appropriately.
- Each institution should develop standard tracheostomy management protocols to enhance patient safety.
- If unable to replace the tracheostomy tube, standard airway management algorithms can be utilized to secure the airway.

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