Patient Instructions

Tracheostomy is still socially stigmatized and can intimidate both the patient and the family. The family's understanding and comfort are most important. Education must begin early, and preparations for discharge must be complete.

Before leaving the hospital, all members of the household should feel comfortable with replacing the outer cannula. Equipment includes saline, suction catheters, and a suction machine for hygiene; replacement inner cannulas; and a spare tube with an obturator. Occasionally, a patient requires humidification via tracheal collar. The most commonly overlooked or misunderstood item is the obturator, which is important in the atraumatic reinsertion of the outer cannula.

Elements of Informed Consent

As with any surgical procedure, a frank and honest discussion should take place between the surgeon and patient (and/or family) regarding the risks, benefits, and alternatives of tracheotomy.

Equipment

A tracheostomy tube is a hollow tube, with or without a cuff, that is electively inserted directly into the trachea through a surgical incision or with a wire-guided progressive dilatation technique. A number of tracheostomy tubes are available.

See Pediatric Tracheostomy for information about tubes for pediatric and neonatal patients.

Tracheostomy tubes are made of various materials, as described in the table below.

Table 1. Tracheostomy Tube Materials  

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
<th>Comments</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyvinyl chloride (PVC)</td>
<td>PVC is produced by polymerization of vinyl chloride monomer</td>
<td>Has a high degree of biocompatibility and flexibility under changing temperatures and humidity</td>
<td>Portex Blue Line Ultra, RÜSCH</td>
</tr>
<tr>
<td>Silicone</td>
<td>Depending on the additives used, properties such as flexibility, opacity, color, heat stability, density, and chemical resistance can be controlled and modified</td>
<td>Easily sterilized but prone to retention of bacteria and is therefore for single use/disposable</td>
<td>Bivona range</td>
</tr>
<tr>
<td>Silicone</td>
<td>Silicone is a synthetic polymer and is produced by a cross-linked polymer reinforced with silica</td>
<td>Reduces adherence of secretions and bacteria to the tube by promoting easier passage for mucus</td>
<td>Can be sterilized but confined to single patient use</td>
</tr>
<tr>
<td>Siliconized PVC</td>
<td>Thermosensitive PVC, provides sufficient rigidity for initial insertion, and then softens at body temperature to accommodate to individual patient’s anatomy</td>
<td>With proper humidification, secretions are less likely to adhere to the tube, making it easier to clean</td>
<td>Portex Blue Line range</td>
</tr>
</tbody>
</table>
### Tracheostomy Periprocedural Care: Patient Education & Consent, Equipment, Patient Preparation

The ideal tracheostomy tube should be rigid enough to maintain an airway and yet flexible to limit tissue damage and maximize patient comfort. The tracheostomy tube is arc-shaped or angled, which allows a correct entry angle into the trachea and reduces the risk of trauma to the tracheal wall.

In some institutions, open tracheostomy kits are available. These kits consist of sterile towels with prep-drape kit and sterile gloves, no. 15 or 10 blades with handle, electrocautery Bovie, Adson pickups, Richardson retractors, tracheal spreader, tracheostomy tube, hemostats, suctioning device, and ties.

### Tube size

The ideal tube size for a patient is one that maximizes the functional internal diameter while limiting the outer diameter to approximately three quarters of the internal diameter of the trachea. This reduces airway resistance and the work of breathing while facilitating airflow around the tube. The distal end of the tube should sit comfortably in the trachea and no closer than 1-2 cm from the carina.

In patients of average habitus, a no. 6 Shiley cuffed tracheostomy tube is appropriate for most women and no. 8 Shiley cuffed tracheostomy tube is appropriate for most men. More care must be taken in the patient with obesity; a flexible single-lumen variable-length tube may be most appropriate. A tube that is too short abuts the posterior tracheal wall, causing obstruction and ulceration. A tube that is too long curves forward and erodes the anterior tracheal wall, which can be perilously close to the innominate artery.

Extra-long tracheostomy tubes are available to use in certain situations. Extraproximal-length tubes facilitate placement in patients with large necks, and extradistal-length tubes facilitate placement in patients with tracheal anomalies. Several tube designs have a spiral wire reinforced flexible design and have an adjustable flange design to allow bedside adjustments to meet extra-length tracheostomy tube needs.

The Bivona tracheostomy tube is much like a foreshortened endotracheal tube. It has a grip that secures the tube at the desired position. One disadvantage is that...
the Bivona tracheostomy tube is a single-lumen tube. Meticulous care must be taken because this tube does not have an inner cannula to remove for cleaning. Additionally, obstruction of the tube by secretions necessitates removal of the outer cannula in the patient with a difficult airway. The variable length of the tube requires that placement be checked, either endoscopically or radiographically, to avoid mainstem ventilation.

In 2006, Tibballs et al reported complications using the Bivona tracheotomy tube.[6] They cited problems related to the tube's tendency to straighten itself once it is bent and inserted into the trachea through the tracheostoma. These problems include tracheal ulceration (1 case), distortion of tracheal soft tissue (1 case), and airway obstruction when the tip embedded into the tracheal wall (1 case).

**Cannulae**

The outer cannula is the main body of the tube that passes into the trachea. Single-lumen tubes contain only the outer cannula (see image below). The stated size of the tube usually refers to the inner diameter of this outer cannula expressed in millimeters.

Some tracheostomy tubes allow an inner tube, which is removable. This allows maintenance of a clear airway by removing just the inner tube to clear secretions. There are a variety of re-usable, disposable, plain, and fenestrated inner tubes.
Cuffed tubes

Cuffed tubes allow positive pressure ventilation and prevent aspiration. If the cuff is not necessary for those reasons, it should not be used because it irritates the trachea and provokes and trap secretions, even when deflated. Even modern low-pressure cuffs should be deflated regularly (four times a day) to prevent pressure necrosis.

Indications for a cuffed tracheostomy tube include the following:[6, 7, 8, 9]

- Risk of aspiration
- Newly formed stoma in adult
- Positive-pressure ventilation
- Bleeding (eg, in a multiple trauma patient)
- Unstable condition

Contraindications for a cuffed tracheostomy include the following: [6, 7, 8, 9]
- Child younger than 12 years
- Significant risk of tracheal tissue damage from cuff

Indications for an uncuffed tracheostomy tube include the following:
- Stable stoma
- Pediatric and neonatal patients
- Upper-airway obstruction due to tumors or neuromuscular disorders causing vocal cord palsy

Contraindications for an uncuffed tracheostomy include the following:
- Dependent on positive-pressure ventilation
- Significant risk of aspiration
- Newly formed tracheostomy

**Fenestrated tubes**

Some tubes have single or multiple fenestrations on the superior curvature of the shaft (see image below). Fenestrations permit airflow, which, in addition to air leaking around the tube, allows the patient to phonate and cough more effectively. Fenestrated and nonfenestrated inner tubes are supplied with these tubes.
Fenestrated cuffed and uncuffed tubes.

Fenestrated tubes are contraindicated in patients who require positive-pressure ventilation, as some of the air will leak out of the fenestrations.

Standard fenestrations are rarely in the right place; if flush with the tracheal wall, they instead cause irritation and granulation and should not be used.

**Flange or neck plate**

The neck plate attached to the proximal end of the tube prevents the tube from descending into the trachea and allows for securing the tube with tapes, ties, or sutures. The tube size and type is often imprinted on the neck plate for easy identification. Certain tubes have a swivel neck plate that rotates on two planes and facilitates dressing and wound care.

![Adult swivel, neonatal, and pediatric neck flanges.](image)

Certain tubes have an adjustable flange that allows variable tube length and may be useful in patients with larger necks. These also allow distal tracheal obstructions to be bypassed through a conventional tracheostomy.
Bivona and Portex adjustable-neck-flange tubes.

Pilot balloon

Cuffed tubes have an external balloon that is connected to the internal cuff by an inflation line. When the external balloon is inflated, the distal cuff inflates and provides a tight seal against the wall of the trachea.

Introducer/obturator

This is a bevel-tipped shaft, which is placed inside the outer cannula of the tube during tube insertion. It has a smooth rounded tip that reduces trauma to the trachea during tube placement.

Adaptor, 15-mm

Single-lumen tubes and the inner cannula of the double-lumen tubes have a universally sized 15-mm hub that allows attachment to the ventilation equipment. When the patient’s condition stabilizes, these tubes are exchanged for a tube that lies flush with the neck and improves cosmetic appearance.

Custom tube designs

When a standard tracheostomy tube does not provide an adequate fit for a patient, almost all manufacturers offer custom tube services. Modification such as longer or shorter tube shafts, additional sizes, customized cuffs, modified neck flanges, curvatures, and fenestration locations are possible.

Equipment list for procedure

When a percutaneous tracheostomy is being performed, the following equipment can be used:

- A percutaneous dilatational tracheostomy kit, which includes a 22-gauge needle and syringe, 11-F short punch dilator, 1.32-mm guidewire, 8-F guiding catheter, 16-F, 21-F, 24-F, 28-F, 32-F, 36-F, and 38-F dilators; Shiley no. 8 double-cannula tracheostomy tube; and fiberoptic bronchoscope
- A guidewire dilating forceps kit, which includes a 14-gauge needle and syringe, J-tipped Seldinger guidewire, scalpel, Howard-Kelly forceps modified to produce a pair of guidewire dilating forceps, and Shiley no. 8 double-cannula tracheostomy tube with curved obturator
- A Rapitrach kit (Fresenius, Runcorn, Cheshire, UK), which includes a 12-gauge needle and syringe, short guidewire, scalpel, Rapitrach percutaneous tracheostomy dilator, and standard Portex 8-mm tracheostomy tube with curved obturator
- Ciaglia Blue Rhino kit (Cook Critical Care, Bloomington, IN), which includes a 14-gauge catheter introducer needle and syringe, J-tipped Seldinger guidewire, guiding catheter, introducer dilator, loading dilators, single tapering Blue Rhino dilator, Shiley no. 8 double-cannula tracheostomy tube with curved obturator, and fiberoptic bronchoscope

Patient Preparation

Anesthesia

The use of anesthesia depends on the clinical scenario. In emergent cases, no need for local anesthetic is required. In an emergent situation, obtaining an airway is the prime goal and cricothyroidotomy will be the procedure of choice.

In elective situations, local anesthetic is indicated. Lidocaine or lidocaine with epinephrine (lidocaine 1% with 1:150,000 parts epinephrine) can be used. The
standard recommended doses are 3-4 cc/kg of lidocaine alone or 5-7 cc/kg of lidocaine in combination with epinephrine. However, many patients who require a tracheostomy are already in an intensive care setting under multiple drips (sedatives/analgesics) that will keep the patient in an adequate state during the procedure.

**Monitoring & Follow-up**

A tracheostomy can be used for days or, with proper care, for years. Research indicates that patients can be discharged from the intensive care unit with a tracheostomy cannula without adding morbidity or mortality.\[10\]

Postoperative care is critical. The recently insulted trachea produces copious secretions, so irrigation with saline and suctioning every 15 minutes is not initially unreasonable. Suctioning should be limited to the length of the tube to avoid tracheal ulceration and tracheitis. Suctioning should be performed under aseptic conditions with the patient sitting upright, when possible. Suctioning should be performed with the inner tube in situ and ideally with a nonfenestrated inner tube. The suction catheter should have a diameter no greater than half the internal diameter of the tracheostomy tube. The sizing formula is as follows: Suction catheter size (Fg) = 2 X (size of tracheostomy tube - 2)

The lowest possible vacuum pressure should be used to minimize atelectasis. Patients with a high oxygen demand may require preoxygenation. The suction catheter should be advanced 10-15 cm into the tube before applying suction and slowly withdrawn. Suction should not be applied for more than 10 seconds. If any difficulty in passing the suction catheter is encountered, tube displacement and/or tube blockage should be suspected.

The pressure within the cuff should be checked regularly with a handheld pressure manometer and maintained ideally between 20 and 25 cm H\(_2\)O.\[11\] It should never exceed 25 cm H\(_2\)O. If an air leak occurs with the cuff pressure at the maximum recommended, the tracheostomy may have become displaced and may require changing. Ideally, the cuff should be deflated as soon as the patient is able to deal with secretions and the risk of aspiration is reduced.

Humidified oxygen helps prevent inspissation of the secretions. Additional mucolytic agents (eg, acetylcysteine [Mucomyst], guaifenesin) may be used. If uncorrected, mucus that plugs the inner cannula can cause a life-threatening obstruction.

The original tube is left sutured in place for 5-7 days to allow the tract to heal. The sutures are then removed, and the tube is replaced. For patients in whom the tracheostomy was an acute intervention, this is an opportunity to downsize the tube or to change to a metal (Jackson) tube. The site should be kept clean and dry to minimize infection from what is a chronically colonized location. Patient and family education should begin as soon as possible.

The tracheostomy tube should be removed as soon as is feasible and therefore should be downsized as quickly as possible. This allows the patient to resume breathing through the upper airway and reduces dependence (psychological and otherwise) on the lesser resistance of the tracheostomy tube. Decannulation may be performed when the patient can tolerate plugging of the tracheostomy tube overnight while asleep without oxygen desaturation. After the tube is removed, the skin edges are taped shut, the patient is encouraged to occlude the defect while speaking or coughing. The wound should heal within 5-7 days.

In preparation for decannulation, the tracheostomy tube may be plugged. The patient must be able to remove the plug should dyspnea develop. Patients with sleep apnea frequently keep their tubes plugged except when they go to sleep.

**Speaking & Swallowing**

Phonation is an important process that should be encouraged as soon as the patient is in adequate condition to tolerate passive closure sessions of the tracheostomy site. As soon as the cuff can be deflated, the patient should be encouraged to occlude the tube with a finger and to begin to phonate.

As long as no significant edema is present, enough air should pass by the tube and through the vocal cords. This also encourages the patient to reestablish normal airflow through the upper airway and diminishes psychological reliance on the lesser resistance of the tracheostomy. Passy-Muir valves are special 1-way valve caps that allow automatic occlusion with exhalation for speech. Negative pressure (inspiration) opens the valve. Fenestrations are rarely in the correct place. Simply deflating the cuff or, preferably, downsizing to a cuffless tracheostomy tube should suffice for audible speech.

Swallowing is another mechanism that should be tested as soon as the patient is in adequate condition to start taking oral feeding. Swallowing is more difficult while the tube is in place because of decreased laryngeal elevation; however, oral intake is certainly possible. Thoroughly evaluate the patient’s risk of aspiration before feeding begins.

Special teams dedicated to speech and swallow functions are usually involved to evaluate this process. They can recommend if the patient is in good condition to start oral feeding, as well as an appropriate diet for the particular condition to prevent aspiration and further complications.
Complications

Several complications have been described during open and percutaneous tracheostomies. Most of the complications are life-threatening. For this reason, prevention, early diagnosis, and treatment are key factors during this procedure.

Immediate Complications of Tracheostomy

Apnea due to loss of hypoxic respiratory drive is mainly important in the awake patient. Ventilatory support must be available.

Intraoperative bleeding may arise from the cut edges of the very vascular thyroid gland and from lacerated vessels in the field that should be cauterized or ligated. Care should be taken to stop all thyroid bleeding before the cut edges are allowed to retract laterally, which makes them difficult to expose.

Pneumothorax or pneumomediastinum can result from direct injury to the pleura or the cupula of the lung (especially in children) or from high negative inspiratory pressures of patients who are awake and distressed. Early recognition is critical, and routine postoperative chest radiography should be considered after tracheotomy.

The paratracheal structures vulnerable to injury are the recurrent laryngeal nerves, the great vessels, and the esophagus. This danger is most prevalent in children because the softness of the trachea hinders its identification if it is not distended with a rigid object.

Although rare, a transient pulmonary edema can occur after tracheostomy, which provides relief of upper airway obstruction.

Endotracheal tube ignition is a rare complication associated with opening the trachea by electrocautery or laser.[12]

Early Complications of Tracheostomy

Early bleeding is usually the result of increased blood pressure as the patient emerges from anesthesia (and relative hypotension) and begins to cough. Although this may necessitate a return to the operating room, bleeding may be controlled with local packing and hypertension control. Packing should involve antibiotic-impregnated gauze (eg, iodophor). The patient should be given antistaphylococcal antibiotics while the packing is in place. Bloody secretions that issue from the tube may represent diffuse tracheitis (most commonly), rundown bleeding from the skin or thyroid, or ulceration from an ill-fitting tube or overzealous suctioning.

The use of dual cannula tubes lessens the threat of mucus plugging because the inner cannula can be removed for cleaning while the outer cannula safely maintains patency of the fresh tract. However, vigilance is still required, and all measures to thin and to remove secretions should be undertaken.

To some degree, tracheitis is present in all patients with fresh tracheostomies. Humidification, minimization of the fraction of inspired oxygen (because high oxygen levels exacerbate drying), and irrigation are essential. Moreover, motion of the tube within the trachea is extremely irritating and should be prevented with stabilization of the ventilator circuitry so that torsion is minimized.

The wound is colonized quickly; however, infection is unlikely if the incision has not been closed tightly and drainage is allowed. Opening the wound and instituting appropriate antibiotics should suffice to treat any early cellulitis.

The need to replace a new tracheostomy tube is not uncommon. In this situation, remember the access that the upper airway still affords. Bag-ventilate the patient and prepare for intubation if the tracheostomy tube cannot be replaced. Initial management includes passing an object (eg, smaller tube, clear nasogastric tube that shows the fogging of respiration) into the open wound.

A physician may attempt recannulation. This is facilitated with placement of the tube over the fiberoptic laryngoscope and reentry of the trachea under direct vision. However, endotracheal intubation remains the mainstay of airway management and should not be ignored while an increasingly traumatized tracheostomy site is labored over. Misplacement of the tracheostomy tube into the dreaded false passage, usually in the pretracheal space, should be suspected in the presence of difficult ventilation or passage of a suction catheter or if subcutaneous air or pneumothorax develops.

Subcutaneous emphysema results from a tight closure of tissue around the tube, tight packing material around the tube, or false passage of the tube into pretracheal tissue. It can progress to pneumothorax, pneumomediastinum, or both and should be treated with loosening of the closure or packing and with performance of a tube thoracotomy, if necessary. Incidence of pneumothorax after tracheostomy is 0-4% in adults and 10-17% in children; thus, postoperative chest radiography is recommended in children.

An overly long tube can mimic a unilateral mainstem intubation, causing atelectasis or collapse of the opposite lung.

Late Complications of Tracheostomy
Bleeding more than 48 hours after the procedure may herald a tracheoinnominate fistula caused by a low (farther along the trachea toward the carina) tracheostomy or an ill-fitting long tube. One half of patients with significant bleeding more than 48 hours after the procedure have tracheoinnominate erosions. This occurs in 0.6-0.7% of patients with tracheostomies, and the mortality rate of this complication approaches 80% depending on the aggressiveness of treatment.

Patients with an impending tracheoinnominate fistula may have a sentinel bleed (ie, brief episode of brisk bright red blood from the tracheostomy site) hours or days before catastrophic bleeding. Some physicians prefer to investigate all such episodes of bleeding with a careful tracheobronchoscopy, looking for suggestive areas in the appropriate area of the trachea.

If diagnosis is made only when catastrophic bleeding occurs, management includes replacement of the tracheostomy tube with an endotracheal tube with the balloon inflated distally to the site of the bleeding to protect the airway. If the balloon does not tamponade the bleeding, a well-placed finger can temporize while the thoracic surgery team mobilizes for median sternotomy to locate and to control the bleeding vessel.

Occasionally, granulation tissue at the tip of the tracheostomy tube can bleed vigorously. This can be identified via flexible laryngoscopy and can be treated with excision or cautery via bronchoscope in the operating room.

Tracheomalacia is usually caused by a tube that fits poorly. Improved fit may allow recovery of the softened cartilage.

Injury to the cricoid cartilage, the only circumferential ring in the trachea, can lead to laryngeal stenosis. Stenosis typically occurs at the site of the tracheostomy or at the tip of the tube irritated by the cuff. Modern high-volume low-pressure cuffs have reduced the rate of post-tracheostomy stenosis. However, care must still be taken not to overinflating these cuffs and to deflate them periodically.

Tracheal stenosis typically develops several weeks after decannulation as subacute distress and is often mistaken for bronchitis. Treatment is surgical and ranges from formal resection and reconstruction to less invasive means of debridement or stenting for palliation. Videos of tracheal stenosis are included below.

This video demonstrates the results of rigid direct laryngoscopy and flexible tracheal endoscopy in a patient with significant tracheal stenosis.

This video demonstrates the 90-degree endoscopic view in 2 patients with tracheal stenosis.

This video of a 90-degree endoscopic tracheal view was obtained from a patient with postintubation tracheal stenosis.

This video demonstrates the 90-degree endoscopic view in 2 patients with tracheal stenosis.

A tracheoesophageal fistula, which is typically caused by friction between a posteriorly displaced tracheostomy tube or overinflated cuff and a rigid nasogastric tube, almost always requires surgical repair, possibly with a muscle flap, skin graft, or both. A tracheoesophageal fistula manifests as aspiration and subsequent chemical pneumonitis and should be evaluated with a plain film (which may show an air-filled esophagus) or barium swallow, followed by bronchoscopy. Preoperative management includes gastrostomy decompression and jejunostomy nutrition. This complication occurs in less than 1% of patients with tracheostomy.

Epithelialization of the tract from skin to trachea can result in a nonhealing fistula. This can be repaired with coring out of the epithelial layer and allowance of the wound to granulate in. Alternatively, a 3-layer closure can be performed, but this is associated with more complications. A persistent tracheoesophageal fistula can indicate proximal resistance or a remaining obstruction and should be evaluated via direct laryngoscopy.

Granulation can occur at the site of the stoma and should be cauterized with silver nitrate. It can also occur distally, where it may cause partial or complete obstruction or cause this friable tissue to bleed. As granulation matures into fibrous scar, it can contribute to stenosis.

Both vertical and horizontal incisions heal with small but visible scars that can be revised if they bother the patient.

Sometimes, plugging trials or even decannulation fails for no apparent reason. Possibilities to consider include obstructing granuloma previously held out of the way with the tube, bilateral vocal cord paralysis, in fractured cartilage, and anxiety. Evaluation should include fiberoptic laryngoscopy and bronchoscopy through the stoma, with visual inspection down at the carina, up at the glottis, and then through the nose to view the hypopharynx and the supraglottis.

In 2009, Tobin proposed that the use of a tracheostomy team may reduce morbidity of this indwelling respiratory device.[13]

### Percutaneous Tracheostomy Versus Open Surgical Tracheostomy

Numerous articles have been published comparing several techniques of percutaneous tracheostomy with open surgical tracheostomy, as well as with one another. In general, most have shown similar complication rates.

In a meta-analysis of studies, Dulguerov et al[14] found more frequent perioperative complications in the percutaneous cohort (10% vs 3%) but more postoperative complications with the surgical approach (10% vs 7%). Also noted was a higher
incidence of perioperative death (0.44 vs 0.03%) and serious cardiorespiratory events (0.33% vs 0.06%) in the percutaneous group.

Cheng and Fee(15) analyzed 4 studies showing percutaneous tracheostomy required shorter operative times (8 minutes vs 20.9 minutes), produced less intraoperative minor bleeding (9% vs 25%) and postoperative bleeding (7% vs 18%), and resulted in fewer overall postoperative complications (14% vs 60%), including stomal infection (4% vs 29%), pneumothorax (1% vs 4%), and death (0% vs 3%).

Freeman et al(10) analyzed 5 studies and found that the percutaneous method was associated with shorter operative time (absolute difference of 9.84 minutes), less perioperative bleeding, lower overall postoperative complication rate, and lower postoperative incidence of bleeding and stomal infection. No difference was identified in overall operative complications, days intubated prior to tracheostomy, or death.

Higgins and Punthakee published a meta-analysis that showed no significant difference when comparing overall complications, with a trend toward favoring percutaneous method. However, the more serious and life-threatening complication of decannulation/obstruction was more likely to occur with the percutaneous technique and false passage trended toward favoring the open procedure. Nevertheless, no significant difference was shown between the 2 methods in regards to death.

### Prolonged Intubation

Prolonged mechanical ventilation has become possible and increasingly necessary as advances have been made in the care of patients with a critical illness.

With antibiotics, total parenteral nutrition, and dialysis, current interventions allow almost indefinite support.

Complications of prolonged intubation include ulceration, granulation tissue formation, subglottic edema, and tracheal and laryngeal stenosis.

Pulmonary hygiene and oral hygiene are difficult. Communication is frustrating, and deglutition can be very difficult.

The change from an endotracheal tube to a tracheostomy tube decreases dead space by 10-50%.

Decreased resistance increases compliance and facilitates independent breathing.

The work of breathing is significantly less through a 6- to 12-cm tracheostomy tube than through a 27-cm endotracheal tube. Weaning a patient off mechanical ventilation is greatly facilitated by this decreased work of breathing. Intermittent rests on the ventilator, usually at night, are also possible.

Tracheostomy provides a more secure airway, is less likely to be displaced, and is more readily replaced than the traditional endotracheal tube.

Tracheostomy has not been demonstrated to pose a greater risk of pneumonia than intubation because both interventions lead to colonization of the airway with potential pathogens. In a study of tracheostomy in mechanically ventilated adult patients in an intensive care unit, Terragni et al found no statistically significant difference in the rates of ventilator-associated pneumonia with early tracheostomy (after 6-8 days of laryngeal intubation) versus late tracheostomy (after 13-15 days of laryngeal intubation).(16)

Timing of tracheostomy in patients who are critically ill and intubated is controversial. A large retrospective cohort analysis including nearly 11,000 critically ill patients evaluated the impact of tracheotomy timing on mortality. The authors found a slight overall improvement in survival in patients who undergo tracheotomy within the first 10 days of intubation.(17)

### Pediatric Patients

Indications for pediatric tracheotomy are similar to those for adults. Airway obstruction is the leading indication for tracheotomy, followed by ventilatory support and pulmonary toilet.

Studies have shown a change in the indications and outcomes of pediatric tracheotomies. Pediatric tracheotomy is more frequently performed today for chronic diseases than for acute infections such as supraglottitis, as was the case in the 1970s. This change in indications is associated with an increase in the duration of these tracheotomies and a decreased decannulation rate.

See Pediatric Tracheostomy.

### Contributing Information and Disclosures

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