

From Open to Bedside Percutaneous Tracheostomy



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KEYWORDS

• Tracheostomy • Ventilation • Weaning • Percutaneous • Prolonged ventilation

KEY POINTS

- Tracheostomies can facilitate weaning from the ventilator in patients anticipated to require prolonged ventilation as well as potentially resulting in improved patient communication, quality of life, and reduced injury to vocal folds.
- Late and serious complications, such as tracheoarterial fistulae and tracheal stenosis, can occur.
- Percutaneous tracheostomy has replaced open tracheostomy as the first-line approach owing to lower complication rates and reduced resource use.
- Different variations of percutaneous tracheostomy have arisen over time; the most commonly used method seems to be serial dilatation technique (popularized by Ciaglia) with bronchoscopic assistance.

INTRODUCTION

Patients requiring mechanical ventilation require access to the airway and this is achieved via endotracheal intubation. Tracheostomy is another method to achieve this access. This article focuses on tracheostomy in the setting of a patient that has an in situ larynx.

POTENTIAL BENEFITS OF TRACHEOSTOMY

Although endotracheal tubes (ETTs) are less invasive than tracheostomies as a first means to access the airway, there are benefits to tracheostomies that often prompt clinicians to consider conversion to a tracheostomy once an ETT is in place. Many of these, in combination, are often cited as potentially facilitating easier and more successful weaning from the ventilator in

patients who are anticipated to require prolonged ventilation.

Ventilatory Mechanics and Facilitation of Weaning

Although dead space ventilation and tidal volumes are not likely to be improved by tracheostomy, there is evidence to suggest that there are improvements in ventilator synchrony.^{1,2} Furthermore, the literature suggests reductions in work of breathing, auto-positive end-expiratory pressure, inspiratory pressures, and airway resistance with tracheostomy in both spontaneously ventilating and mechanically ventilated patients.^{1,3-5} Thus, it is hypothesized that weaning from the ventilator may be facilitated by tracheostomy; improvements in standardized weaning metrics after tracheostomy support this hypothesis.⁶ In many

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ways, there seems to be a multifactorial and self-perpetuating pattern that can occur with tracheostomy with respect to facilitating weaning from ventilation. Reductions in work of breathing, patient discomfort, and ventilator asynchrony tend to lead to reduced need for sedation. This process can then lend itself well to more opportunities for spontaneous breathing trials.⁷

In patients that would otherwise be able to spontaneously ventilate but who have poor ability to clear secretions, tracheostomies can improve pulmonary toileting and secretion control. This step may facilitate earlier weaning and also reduce the need for reintubations.⁸

Patient Communication

The use of tracheostomy facilitates return to verbal communication. This has a significant impact on improvements in patient quality of life because the reduced ability to easily communicate during mechanical ventilation seems to be one of the most common causes of suffering and frustration for patients.^{9–16} In many patients, just the fact that the ETT is not going through their mouth and glottis results in increased comfort.^{7,17} Different mechanisms can be used to progress patients toward verbal communication. These include 1-way valves (ie, Passy-Muir valves) that require cuff deflation, advanced tracheostomies that can expel air above an inflated cuff (ie, “talking” tubes) or tracheostomies that rely on dynamic cuff inflation and deflation during different phases of respiration.^{12–16}

Patient Quality of Life

There is a small body of literature suggesting better patient quality of life with tracheostomy. Early tracheostomy was also shown to be associated with better patient quality of life.¹⁸ These studies used validated quality-of-life measures that patients could use while being mechanically ventilated. Of particular importance, the most important domains of these quality-of-life tools are the domains of speech and pain. This finding suggests that the biggest drivers of improved quality of life in patients with tracheostomy were reduction in pain and improved ability for speech. This finding supports the notion that tracheostomies improve comfort and facilitate patient communication.^{19–21}

Reduced Vocal Fold Injury and Dysfunction

Translaryngeal intubation with ETT for as little as 48 hours has been reported to be associated with 20% to 40% incidence of transient vocal fold immobility/dysfunction with most returning to

normal function within a month. It is unclear what duration of translaryngeal intubation leads to irreversible vocal fold dysfunction.²² Thus, many clinicians seem to suggest a transition to tracheostomy after 2 weeks of translaryngeal ETT.^{22,23}

EARLY VERSUS LATE TRACHEOSTOMY

Once the decision to proceed to tracheostomy has been made, the next issue to resolve centers around the timing of tracheostomy in patients anticipated to require prolonged ventilation. This issue is complicated by multiple factors; however, these multiple factors are most likely sequelae of an unclear definition of “early” and “late” and imperfect/unreliable ability to predict those who will require short term ventilation. The definition of early tracheostomy ranges from tracheostomy within 4 days to 2 weeks after intubation. The definition of late tracheostomy ranges from anything beyond 10 days to anything beyond 3 weeks. As a result, many studies have failed to consistently identify any significant advantages from early tracheostomy.^{24–26} Randomized data suggest that earlier tracheostomy (within a mean of 7 days after intubation) resulted in increased weaning from ventilator and lower intensive care unit duration of stay with no differences in 30-day mortality as compared with later tracheostomy.^{27,28} In one of these randomized, controlled trials, patients in the late tracheostomy group had tracheostomies within a mean of 14 days. Thus, one of the criticisms of this trial is that there likely was not much reasonable difference in the timing of tracheostomy between the groups. Another criticism is related to the number of patients that were randomized to each group but did not end up getting a tracheostomy (ie, because of extubation). Nearly one-third of the early group and one-half of the late group did not get a tracheostomy, suggesting that even the late tracheostomy group resulted in patients undergoing a procedure that they possibly did not need.²⁷

If tracheostomy insertion could be done without complications, it could be argued that all the other unmeasured benefits of tracheostomy would still potentially make early tracheostomy worthwhile. However, complications do occur and have been reported to occur in up to 40% of patients; most of these are minor complications, such as stomatitis and stoma site bleeding.²⁷ Thus, most clinicians would not advocate tracheostomy before 7 days.²²

In the end, decision making regarding timing of tracheostomy is best achieved through a collaborative process involving the critical care team, patients, and patients’ families.

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