

What are the indications for performing tracheostomy in ICU patients?

Tracheostomy is indicated in patients who require prolonged ventilation (usually more than a week) and an extended period to wean off ventilator support. A tracheostomy may also be required in patients who are unable to maintain airway with poor ability to cough and clear secretions, necessitating frequent tracheal suctioning. These would include patients with vocal cord related problems, and bulbar weakness due to stroke, neuromuscular weakness, or high spinal cord injury. Patients who repeatedly fail extubation or fail weaning trials may also need a tracheostomy. Upper airway obstruction due to trauma, tumor, or recurrent laryngeal nerve paralysis are also indications to perform a tracheostomy.

Tracheostomy may be appropriate in patients on prolonged ventilation by prolonged translaryngeal intubation, to prevent possible injury to the larynx. An emergency tracheostomy may be required in the “cannot intubate, cannot ventilate” situation.

What are the pros and cons of performing tracheostomy?

Pros

- Tracheostomy tubes are generally more comfortable than translaryngeal tubes.
- In most patients, sedation may be reduced or stopped completely following a tracheostomy.
- Easier to mobilize
- It is possible to eat and drink if the patient is otherwise able to do so
- Speech may be possible through a speaking valve
- The duration of stay in ICU may be reduced by performing an early tracheostomy, especially in patients with neurological disorders.
- A shorter tube leads to lower airway resistance. Besides, the dead space is less with a tracheostomy tube compared to a translaryngeal tube. This may reduce the work of breathing and easier weaning from ventilator support.
- Allows flexibility to alternate between controlled and spontaneous ventilation and enables transition to non-invasive ventilation.

Cons

- Complications related to the procedure, including bleeding, loss of airway, hypoxia, pneumothorax, raised ICP, airway obstruction due to blood clots or secretions.
- Chronic complications include tracheal stenosis, tracheomalacia, and scarring.
- Cost related to the procedure.
- May lead to undue delay in decannulation with the inability to communicate.
- Would it lead to prolonging the inevitable in patients with no hope of meaningful recovery who may be otherwise candidates for end of life care?

What are the different techniques of performing a tracheostomy?

There are two broad techniques of performing a tracheostomy- the open surgical and the percutaneous dilatational technique. In the open technique, a transverse incision is made halfway between the sternal notch and the cricoid cartilage. Following blunt dissection, the strap muscles are retracted sideways, and the isthmus of the thyroid gland is retracted upwards. The trachea is exposed, and an incision is made at the appropriate level, usually, between the second and the third tracheal rings, followed by insertion of the tracheostomy tube. The open procedure may be performed by the bedside or in the theater. With the well-established ease and safety of the percutaneous dilatational technique, the open method is resorted to only if there are anatomical abnormalities, a difficult airway, or in an emergency situation.

The percutaneous dilatational technique was first described by Ciaglia et al. in 1985.¹ It is extensively used in many critical care units around the world. The technique involves passing an introducer needle or cannula followed by insertion of a guidewire. The introducer needle is usually inserted under bronchoscopic guidance. Following blunt dissection, dilatation is carried out, commonly using a single-step, tapered dilator. This is followed by insertion of the tracheostomy tube over the guidewire. Ultrasonography may be used prior to the procedure to check for the presence of blood vessels at the site of the incision; besides, real-time ultrasound guidance facilitates precise insertion in the midline at the desired level (usually between the second and the third tracheal rings).

I guess, there are some variations in this technique - I use Grigg's dilating forceps instead of blue rhino that you described. however, two key things- the use of FOB and the presence of second intensive care doctor are becoming almost mandatory for performing tracheostomy in ICU to minimise the complications associated with this technique.

What's the evidence regarding the appropriate timing of performing a tracheostomy: early vs. late?

What is a good time to do a tracheostomy on your patient who is on mechanical ventilation through an endotracheal tube and extubation seems unlikely in the short term? This question continues to intrigue intensivists in spite of extensive scientific research. One of the early randomized controlled trials (RCT) compared tracheostomy within the first 48 hours of ventilation to a later tracheostomy between days 14–16.² This study revealed marked benefits of an early tracheostomy, including reduced mortality, a lower incidence of pneumonia, and less duration on ventilation and in the ICU. However, most later studies have failed to corroborate these findings.

The TracMan study is the largest, multi-center, RCT that has been conducted to evaluate the possible benefit of an early tracheostomy.⁶ Critically ill patients from 70 general intensive care units across the UK were eligible if they were within 4 days of ICU admission, and, would require at least 7 days of mechanical ventilation according to clinician judgment. An early tracheostomy was performed within the first 4 days of admission to the critical care unit; patients randomized to the control group were subjected to a tracheostomy after 10 days if it was still considered necessary by the clinician.

In the early group, 84.6% of patients underwent a tracheostomy as planned; however, among patients randomized to the late group, only 45% received a tracheostomy. Eighty-nine (19.6%) of patients in the late group were discharged from the ICU by day 10, while 78 (17.2%) were still in ICU, but off ventilator support. Thus, 167 out of the 448 (37%) patients who were allocated to the late group could be weaned off ventilation and extubated by day 10. This staggering statistic suggests that clinicians could easily misjudge the duration of ventilation and the requirement for tracheostomy. All-cause mortality at 30 days, the primary outcome for which the study was powered for, did not differ significantly between groups. The secondary outcomes, including survival rates at

ICU and hospital discharge, and at 1- and 2-year follow-up were also not significantly different. Furthermore, the duration of ventilation and the duration of ICU stay were similar between groups. The sole advantage observed with an early tracheostomy was less use of sedation among 30-day survivors. The targeted sample size could not be achieved as the recruitment rate slowed down over time. Besides, the TracMan trial included only 5% of patients with a primary neurological illness, a subgroup of patients who might probably benefit from an early tracheostomy.

Recent meta-analysis

Two meta-analysis have been published after the TracMan study. The most recent Cochrane study revealed a statistically significant mortality benefit with early tracheostomy (47% vs. 53%). This mortality benefit was observed at the time of the longest follow-up, not at a pre-defined period. There were more discharges from the ICU at 28 days in the early tracheostomy group. The duration of mechanical ventilation did not differ significantly between groups. A decreased duration of sedation was noted with early tracheostomy.⁷

Yet another meta-analysis by Szakmany et al. revealed similar findings, but no mortality difference was observed.⁸

Thanks Dr Chacko..That's a very comprehensive answer. I guess apart from things that you mentioned, there are several key limitations of the available evidence -

• Small number of trauma and surgical patients

- Different outcomes were measured: all-cause mortality versus VAP versus ICU / ventilator-free days
- VAP was not measured in the TracMan trial
- VAP definition was problematic in the Italian trial (CPIS 6 not valid in surgical and trauma patients)
- Control for weaning and sedative/analgesic use in Italian trial, but not in TracMan
- No standardization of tracheostomy technique (open or percutaneous in TracMan, Griggs vs PercuTwist in Italian multi-center trial) & last but not the least
 - Questionable generalisability/external validity as the trials came from Uk/Europe and there is no cost-effective analysis available for resource poor countries.

Current French Guidelines -

R1.3 Tracheotomy in intensive care should not be performed before the fourth day of mechanical ventilation. (GRADE 1+/STRONG agreement)

What is your current practice?

In patients with a primary neurological disorder that requires prolonged airway support, we would perform a tracheostomy as early as feasible. This would include patients with major strokes, severe traumatic brain injury, Guillain Barre syndrome, etc. In other situations, we give it more time, usually more than a week before deciding upon performing a tracheostomy. If the underlying disease process is settling down, but weaning appears likely to be prolonged, we perform a tracheostomy. Usually, the longer you wait, the clearer it becomes regarding whether a tracheostomy may be appropriate or not. We would generally not consider a tracheostomy in a patient who has not recovered to the point to be ready for weaning off ventilator support. Patients who are on high PEEP levels (more than 10 cm H₂O), high inspiratory pressures and requirement for high levels of FiO₂ are generally not considered for tracheostomy.

I concur with you. I guess we have to use the personalised approach rather protocollised approach.

Prognostication is the key. and most of the studies have shown that we as clinicians are not so good in predicting outcomes. So, this issue becomes even more challenging. I suggest use your MDT team as they will add their valuable inputs and thus will help to reduce the subjectivity.

Take home message

- There are relatively few patients who might benefit from a tracheostomy within the first 3–5 days of ventilation.
- Patients with neurological illnesses may be able to be liberated from mechanical ventilation early and cared for in a ward with an early tracheostomy. This may be important, especially when the cost of care is a consideration. However, an important question to consider may be whether performing a tracheostomy would simply prolong the inevitable in patients with no hope of meaningful recovery, who may be otherwise candidates for end of life care?
- A tracheostomy should perhaps also be deferred if the prospect of a reasonably meaningful recovery seems unlikely.
- Patients with neurological problems/ burns/ poly trauma with multiple rib fractures may benefit from an earlier tracheostomy.
- It is also important to consider the clinical situation while contemplating tracheostomy. If reducing the level of ventilator support seems unlikely, there may not be much point in performing a tracheostomy. This applies to patients who may require high levels of PEEP, FiO₂, or inspiratory pressures. Attempting a tracheostomy in this setting may lead to worsening of gas exchange and is more likely to cause harm.
- At the end of the day, instead of asking *when*, it may be more appropriate to ask *on whom* would you do a tracheostomy.

That's so true.. There are still several questions which remain unanswered..Just want to add Don't rush, spend some time, try to judge the trajectory of the clinical course of the patient as much as possible and then decide following MDT discussion.

References

1. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A new simple bedside procedure; preliminary report. *Chest*. 1985;87(6):715-719. doi:10.1378/chest.87.6.715
2. Rumbak MJ, Newton M, Truncale T, Schwartz SW, Adams JW, Hazard PB. A prospective, randomized, study comparing early percutaneous dilational tracheotomy to prolonged translaryngeal intubation (delayed tracheotomy) in critically ill medical patients. *Crit Care Med*. 2004;32(8):1689-1694.
3. Griffiths J, Barber VS, Morgan L, Young JD. Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation. *BMJ*. 2005;330(7502):1243. doi:10.1136/bmj.38467.485671.E0
4. Wang F, Wu Y, Bo L, et al. The timing of tracheotomy in critically ill patients undergoing mechanical ventilation: A systematic review and meta-analysis of randomized controlled trials. *Chest*. 2011;140(6):1456-1465. doi:10.1378/chest.11-2024

5. Gomes Silva BN, Andriolo RB, Saconato H, Atallah AN, Valente O. Early versus late tracheostomy for critically ill patients. *Cochrane Database Syst Rev.* 2012;(3):CD007271. doi: 10.1002/14651858.CD007271.pub2
6. Young D, Harrison DA, Cuthbertson BH, Rowan K. Effect of Early vs Late Tracheostomy Placement on Survival in Patients Receiving Mechanical Ventilation. :9.
7. Andriolo BNG, Andriolo RB, Saconato H, Atallah AN, Valente O. Early versus late tracheostomy for critically ill patients. *Cochrane Database Syst Rev.* 2015;1:CD007271. doi: 10.1002/14651858.CD007271.pub3
8. Szakmany T, Russell P, Wilkes AR, Hall JE. Effect of early tracheostomy on resource utilization and clinical outcomes in critically ill patients: Meta-analysis of randomized controlled trials. *BJA Br J Anaesth.* 2015;114(3):396-405. doi:10.1093/bja/aeu440