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What's new with tracheostomy?

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Tracheostomies are one of the most commonly performed procedures in intensive care unit (ICU) patients [1, 2]. Their use has been increasing [3], likely due to the wider adoption of the percutaneous insertion technique [4]. The safety of percutaneous tracheostomy appears well established for most patients [5] and in the future may be enhanced by further refinements, for example by using ultrasound to ensure anatomical safety [6–8]. However, uncertainty remains regarding the procedure's indications and the subsequent approach to patient management [9].

Indications for performing tracheostomy

Tracheostomies performed in the setting of the ICU are typically considered to be indicated when it is deemed that patients are unlikely to undergo successful extubation in the near future and when the perceived benefits outweigh the risks of continued translaryngeal intubation. These proposed benefits include more patient comfort and decreased sedation requirements, hastened weaning, and improved clinical outcomes (Fig. 1).

Although this indication for tracheostomy may seem intuitive, actually deciding when mechanical ventilation has been sufficiently prolonged has proven challenging. Recent large randomized controlled trials (RCTs) of tracheostomy timing have shifted the pendulum towards delaying tracheostomy decisions, at least among general medical–surgical and cardiac surgery patients [10–13]. Despite differing inclusion criteria and definitions of "early" versus "late" tracheostomy, these trials indicate that the routine performance of earlier tracheostomies is unlikely to reduce mortality or prevent nosocomial infections. The Early versus Late Tracheotomy Study (ELTS) showed that earlier tracheostomies can decrease mechanical ventilation duration and length of stay in the ICU, but that this did not translate into shorter hospitalizations [12]. Most importantly, in two of these RCTs (ELTS and the "TracMan" trial) a surprisingly large proportion of patients assigned to receive delayed tracheostomies were successfully extubated without ever having received the procedure (43 and 54 %, respectively) [12, 13]. Therefore, routinely performing tracheostomies earlier than 4 (TracMan) to 8 days (ELTS) may subject many patients to unnecessary procedures, suggesting that tracheostomies should probably be postponed until after 10 (TracMan) to 15 days (ELTS). These findings also highlight a major limitation of observational studies of tracheostomy timing: these can seldom quantify the number of patients for whom the procedure was considered yet who were successfully managed without it [3, 14].

Future RCTs should therefore help identify the value of "late" versus "later" tracheostomies, ideally using approaches that more accurately identify which patients

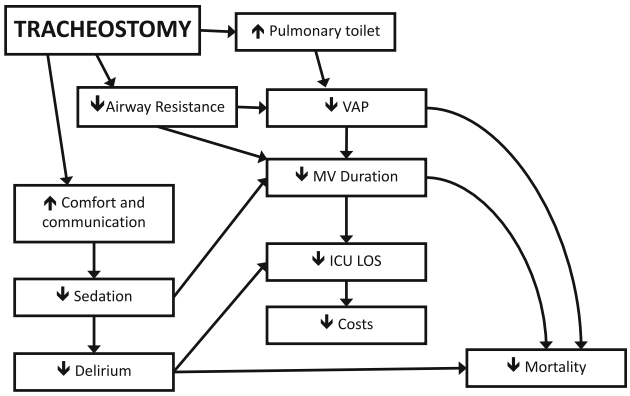

Fig. 1 Tracheostomy proposed causal pathways. The figure depicts some of the mechanisms through which tracheostomy has been posited to improve clinical outcomes. Recent trials have not confirmed many of the intermediate or final steps in these pathways; see text for details. *Up arrow* Improved, *Down arrow* decreased, *VAP* ventilator-associated pneumonia, *MV* mechanical ventilation, *ICU* intensive care unit, *LOS* length of stay

will require prolonged mechanical ventilation. More information is needed to help understand the impact on other patient-centered endpoints, such as sedation requirements, comfort, mobility, communication, and long-term quality of life. Future research should also examine whether some patient populations might benefit from earlier tracheostomy through alternative mechanisms. These include patients with chronic respiratory conditions (clinicaltrials.gov NCT01021202) and those who have decreased alertness and compromised airway protection due to their underlying condition—for example, following neurological injury (clinicaltrials.gov NCT01176214) or stroke [15–17].

Management of patients after tracheostomy

Recent research has helped further elucidate the optimal management of patients who have already received tracheostomies. A recent RCT randomly assigned 316 patients receiving prolonged mechanical ventilation and who failed a 5-day screening procedure to weaning using systematic reductions in pressure support versus daily unassisted breathing via a tracheostomy collar and night-time rests on full ventilator support [18]. Median weaning time was shorter with the tracheostomy collar and night-time rests (15 vs. 19 days; $p = 0.004$), but survival at 6 and 12 months was similar between the groups. Another RCT ($n = 195$) published in this month's issue of *Intensive Care Medicine* shows that tracheostomy cuff deflation during spontaneous T-tube breathing trials of increasing duration hastened weaning in patients who were not deemed to be at high risk of aspiration [19]. The time to mechanical ventilation liberation was shorter in the cuff-deflated group (3 vs. 8 days; $p < 0.01$) and secondary outcomes were also improved, including swallowing (normal drink test 68 vs. 38 %; $p < 0.01$) and respiratory infections (20 vs. 36 %; $p = 0.02$).

There are many opportunities to explore how other aspects of care for the tracheostomized patient can be improved, including the development of strategies to increase mobility and to improve communication or swallowing [20–23]. Recent studies have examined the role of multidiscplinary tracheostomy teams for reducing complications, especially following the discharge of patients with tracheostomies to the ward [24, 25]. Future research is needed to clarify when and where decannulation of tracheostomies should occur [26] and when patients with tracheostomies can be safely transferred out of the ICU [27–29].

Other motivating factors

Decisions to perform tracheostomies may be motivated by financial incentives or a desire to de-escalate treatment requirements [30], for example, by allowing patients to be moved to wards with lower staffing ratios. The main benefits in these situations would appear to be derived by the healthcare system and may be less relevant to the patients themselves, who are the ones actually bearing the risks of the procedures. This creates an ethical dilemma and highlights the importance of conducting high-quality research to better understand how tracheostomies benefit the patient versus the system. Until such research becomes available, informed consent for elective tracheostomies should highlight the anticipated benefits of probably improving patient comfort and reducing sedation and possibly facilitating weaning among patients requiring "prolonged" mechanical ventilation or airway protection.

Conflicts of interest None.

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