VIEWPOINT

Timing of Tracheostomy for Patients With COVID-19 in the ICU—Setting Precedent in Unprecedented Times

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"Uncontrolled variation is the enemy of quality."
W. Edwards Deming, *Basic Statistical Tools for Improving Quality*

Navigating the uncharted has been a pervasive theme during the coronavirus disease 2019 (COVID-19) pandemic, and lack of data to guide decisions has been the most evident regarding the timing of tracheostomy. Tracheostomy, an aerosol-generating procedure with risk of infectious transmission for health care workers,[1] also has important implications for patient care and stewardship of critical resources.[2,3] Emerging data concerning infectivity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the course of patients with COVID-19, and clinical experience may alter practice, even preempting publication. For example, Chao et al[4] originally recommended deferring tracheostomy beyond 21 days of intubation and recommended open surgical tracheostomy over percutaneous dilatational tracheostomy; however, updated practices at the authors' institution reflect outcomes of tracheostomy performed at 10 to 14 days after intubation, with percutaneous technique performed regularly. Similarly, shortly after the New York Head and Neck Society advocated a 14-day standard,[5] the New York University thoracic group published a series of 98 COVID-19 tracheostomy procedures, with surgical procedures at a mean (SD) of 10.6. (5) days of intubation,[6] indicating that many patients underwent tracheostomy well before day 10 of intubation. When COVID-19 overwhelms capacity in intensive care units (ICUs), early timing of tracheostomy may accelerate ventilator weaning and free up critical equipment, staff, and units. Guidelines now recommend that timing of tracheostomy consider scarcity of ventilators and other ICU resources.[3]

Improving clinicians' understanding of COVID-19 is a critical step in reducing uncontrolled variation and improving quality. Misconceptions regarding SARS-CoV-2 and COVID-19 (**Table**) likely contribute to arbitrary variation in timing of tracheostomy; therefore, dispelling misconceptions may encourage consistent standards. In patients with severe COVID-19, the pulmonary injury is extensive, and patients often require prolonged invasive ventilation. One misconception is that virtually all patients will either be extubated or succumb to disease in 2 to 3 weeks. Of note, the opposite misconception has also surfaced—that the course of ventilation is invariably so long that tracheostomy before 3 weeks is pointless. The data support a more nuanced interpretation. COVID-19–associated acute respiratory distress syndrome involves perturbed vasoregulation, often with preserved pulmonary compliance favoring the prone position. Its clinical features and management largely conform to existing parameters and care standards of classic acute respiratory distress syndrome.[7] Tracheostomy should be avoided when prone positioning is necessary and is most appropriate for patients with evidence of recovery. Patients often have thick, viscous airway secretions that may require suctioning via tracheostomy; tenacious secretions may result in prompt reintubation after extubation.

The other major question is how early tracheostomy can be safely performed with appropriate personal protective equipment, including face shields with N95 or FFP3 masks or powered air-purifying respirators, along with fluid-repellent surgical gowns and gloves. Limited data are finally emerging on this pivotal question. No instances of health care worker transmission were reported in the New York University series,[6] and, as of this writing 1 month later, there remain no cases of health care worker transmission despite a dramatic interval increase in number of tracheostomies performed (Robert Cerfolio, MD, written communication, May 22, 2020). The experience at University of Pennsylvania, which moved to the earlier standard of tracheostomy at 10 to 14 days, with 62 COVID-19 tracheostomies, is similarly without signs of transmission to health care workers. One critique of the 10-day standard is that during a COVID-19 surge, which can easily overwhelm ICU capacity, tracheostomy at 10 days' intubation will only free up ICU capacity in patients requiring prolonged weaning.[8] The 10-day threshold also precludes early rehabilitation in patients with preexisting frailty, muscle weakness, and copious secretions, all of which may prompt tracheostomy in patients without COVID-19. Clinicians in Brazil have observed that in patients with COVID-19 and severe comorbidities, earlier tracheostomy (day 4-5 of intubation) improves prognosis. In Brazil, approximately 15% of COVID-19 deaths are occurring in individuals younger than 50 years, a rate that is 10-fold higher than that observed in Italy or Spain (Fernando Dias, MD, Brazilian National Cancer Institute, written communication, May 22, 2020). More data are urgently needed.

When global experts were queried about early, usual, and late timing of tracheostomy in patients with and without COVID-19, there was far wider variation in timing for COVID-19–positive patients.[2] This variation reflects the many unknowns. Prolonged viral shedding has been documented in patients recovering from COVID-19, but positive testing may be due to amplification of an inert virus that cannot grow in culture. This finding is reminiscent of how a rapid *Streptococcus* test may detect persistent antigen in a child long after recovery from streptococcal infection. Nonetheless, personal protective equipment precautions are prudent until duplicate negative results are confirmed. Data on infectivity amid

Table. Misconceptions That Predispose to Uncontrolled Variation in Tracheostomy Among Patients With COVID-19

Misconception	Available evidence	Translation to practice
Safety of the clinicians		
Performing tracheostomy earlier than 21 d is associated with increased risk to health care workers and offers no benefit	• RT-PCR may amplify dead or inert virus • No evidence of increased transmission of COVID-19 when performing tracheostomy at 10 d vs >21 d • Tracheostomy may reduce ICU/hospital days and risk of pneumonia	• Otolaryngologists are encouraged to work with multidisciplinary teams to identify the optimal, patient-centered timing of tracheostomy
Because patients with COVID-19 receiving ventilator assistance may not tolerate apnea or loss of PEEP during tracheostomy, there is elevated risk of exposure to SARS-CoV-2 aerosols	• Owing to favorable pulmonary compliance characteristic of patients with COVID-19, high PEEP is seldom needed • Most patients have sufficient reserve to allow an apneic procedure to be performed, although this finding may differ from patient to patient	• Before surgery, pulmonary reserve and need for PEEP can be assessed with an apnea trial • Dissection to tracheal wall minimizes apnea • In percutaneous technique, placing bronchoscope alongside endotracheal tube reduces aerosols
Benefit to the patient		
Risk of subglottic stenosis and laryngeal complications account for nearly all of the morbidity from prolonged intubation	• Prolonged sedation/intubation for patients with COVID-19 delays rehabilitation, can exacerbate resource scarcity, and may increase risk for thrombotic sequelae (CVA, VTE) or other complications	• Well-established, evidence-based critical care standards should be followed • Prospective trials randomizing to early and late tracheostomy among patients with COVID-19 are needed but may never occur
COVID-19 ARDS requires a fundamentally new care paradigm	• COVID-19 induces severe pulmonary injury, including diffuse alveolar damage, pulmonary microthrombosis, and clinical characteristics that largely mirror classic ARDS	• Proven standards for ARDS are indicated during the pandemic; tracheostomy is not recommended when prone positioning is needed to improve oxygenation
Critically ill patients with COVID-19 "declare themselves" by 21 d after intubation	• While many ICU patients either recover or worsen during this period, roughly 10% of patients require prolonged ventilation, occasionally for many weeks	• Global, multidisciplinary guidance on tracheostomy for patients with COVID-19 suggests 10-21 d as recommended window for tracheostomy[2]

Abbreviations: ARDS, acute respiratory distress syndrome; COVID-19, coronavirus disease 2019; CVA, cerebrovascular accident; ICU, intensive care unit; PEEP, positive end-expiratory pressure; RT-PCR, reverse transcription polymerase chain reaction; SARS-CoV-2, serious acute respiratory syndrome coronavirus 2; VTE, venous thromboembolism.

immune response are not yet available for ventilated patients. Decisions on tracheostomy must be personalized; some patients may be awake but cannot yet be extubated (favoring tracheostomy), whereas other patients may have immediate, severe hypoxemia when lying supine or with any period of apnea (favoring deferral). The broadest engagement among existing guidelines involved a work group spanning approximately 10 specialties and geographies, combining otolaryngology, critical care, pulmonary, anesthesiology, virology, and infectious disease experts alongside medical ethicists and patient and family stakeholders. Using a modified Delphi method, this group evaluated COVID-19 clinical data and timeline of SARS-CoV-2 viral load and the emergence of an immune response, suggesting the 10- to 21-day window.[2]

Early on, the clinical and scientific communities were transfixed by the novelty of SARS-CoV-2, but there is increasing realization that critically ill patients with COVID-19 may be well served by long-standing, data-driven standards of intensive care. The virus's virulence, infectivity, and affected populations will likely change over time, and guidance must adapt as data emerge and local circumstances evolve. Low- and middle-income countries bear a considerable COVID-19 disease burden, and protection of health care workers is of particular concern in settings where personal protective equipment is scarce and clinicians have little experience in tracheostomy care. Whenever possible, multidisciplinary and systematic approaches should be pursued. A 20-hospital quality improvement initiative in tracheostomy care found that multidisciplinary teams with patients, caregivers, and interdisciplinary teams reduced adverse events, mortality, days requiring ventilator assistance, ICU stay, and hospital length of stay.[9] Ideally, prospective randomized trials investigating outcomes of early vs late tracheostomy in patients with COVID-19 receiving ventilation will be conducted to define best practices; however, such studies may be aspirational and may never occur, underscoring the importance of data registries and international data sharing.[10]

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