Optimal Timing and Outcomes Among COVID-19 Patients Undergoing Tracheostomy

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Background

- Acute respiratory failure is a known complication of COVID-19.
- Tracheostomy is commonly performed when anticipated that patient will require prolonged mechanical ventilation.
- Up to one-third of patients requiring prolonged mechanical ventilation now undergo tracheostomy[1].
- Advantages of tracheostomy includes less sedation, expedited weaning from mechanic ventilation, and improved patient comfort.
- We hypothesized that patients with COVID-19 who underwent tracheostomy would have lowered inpatient mortality and that there is an optimal time to perform tracheostomy in these patients.

Methods

- Retrospective cohort study within large hospital system in the United States.
- Included patients with laboratory-confirmed COVID-19 from 1/1/20 to 9/30/20.
- 93,918 cases identified.
- Patients excluded if: did not undergo intubation or tracheostomy, underwent tracheostomy before intubation, <18 years old, hospice patients before admission, and bacterial pneumonia.
- 5,911 patients met criteria for study
- Compared outcomes between patients who underwent endotracheal intubation only (control) and those who underwent tracheostomy.
- Primary outcome: inpatient mortality
- Secondary outcomes: ventilator-associated pneumonia (VAP), pulmonary embolism (PE), myocardial infarction (MI), cerebrovascular accidents (CVA), acute kidney injury (AKI), acute respiratory distress syndrome (ARDS), hospital disposition, hospital length of stay (HLOS), total mechanical ventilator days after initial intubation (TMVD), and additional mechanical ventilator days after tracheostomy (AMVD).
- 3 cohort analysis compared early (<10 days) vs late (>10 days) time to tracheostomy vs control.
- 8 cohort analysis compared days 0-2, 3-6, 7-10, 11-14, 15-18, 19-22, 23+ to tracheostomy vs control.

Results

- Overall inpatient mortality rate 37.5% in tracheostomy group compared to 54.4% in control group (p-value <0.0001).
- Early tracheostomy group (<10 days) had inpatient mortality rate of 44.7% (aOR 0.73, 95% CI 0.52, 1.01) compared to 33.1% (aOR 0.44, 95% CI 0.34, 0.58) in late tracheostomy group (>10 days).
- Overall, the tracheostomy cohort was more likely to be discharged to a long term acute care hospital (33.9 vs 3.8%, p-value 0.0001).
- Patients who had tracheostomy placed had longer HLOS (35.8 vs 16.4 days, p-value <0.0001), mean total days on mechanical ventilation (21.6 vs 7.4, p-value <0.0001), higher rates of VAP 9.9 vs. 1.9% (aOR 5.57, 95% CI 3.75, 8.26, p-value <0.0001), PE 5.3% vs. 3.2% (aOR 1.83, 95% CI 1.14, 2.92, p-value 0.01), AKI (aOR 1.36, 95% CI 1.08, 1.84, p-value 0.01), and ARDS (aOR 1.41, 95% CI 1.08-1.84, p-value 0.01).

Tables and Figures

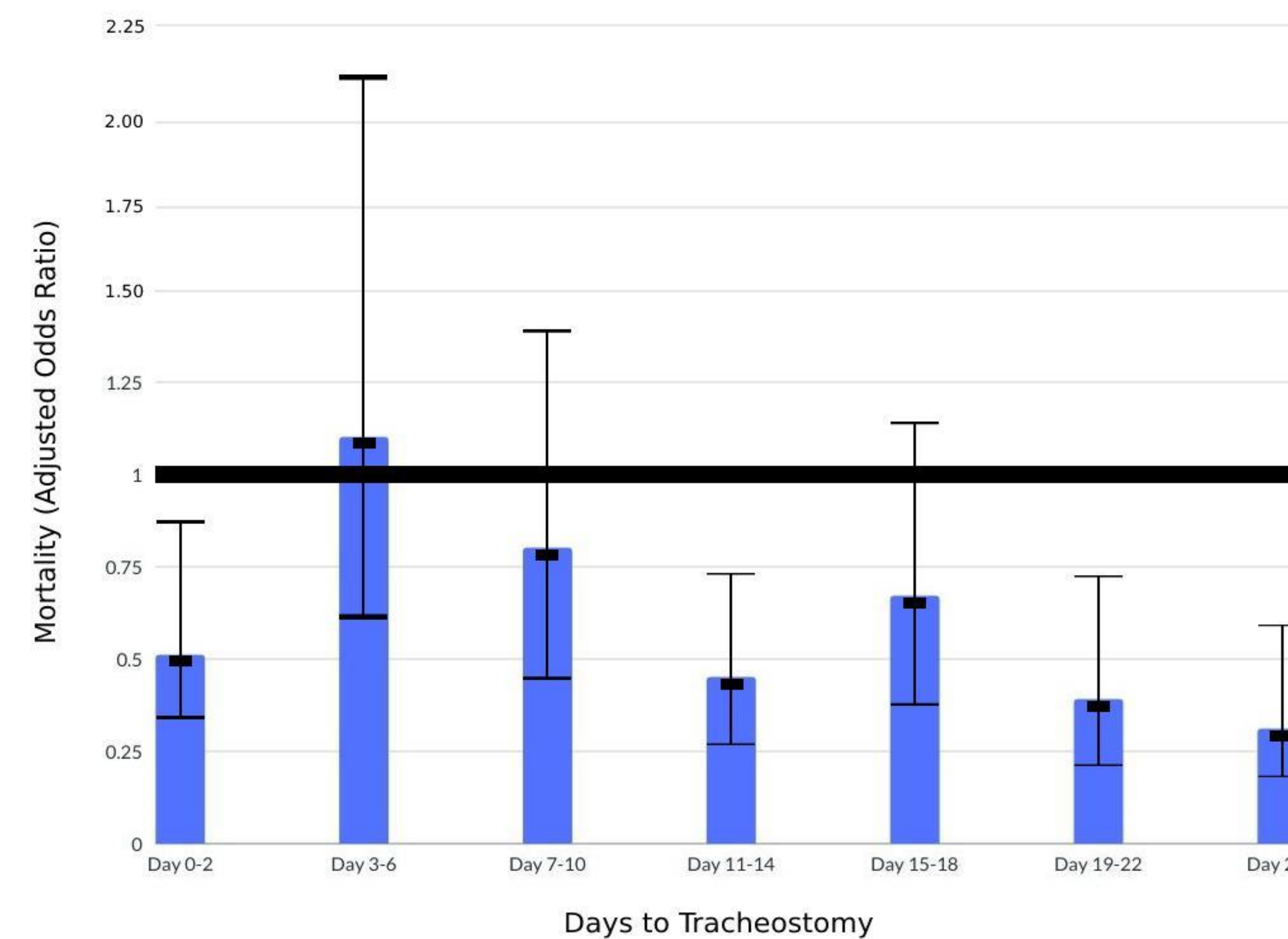### MORTALITY ADJUSTED ODDS RATIO AS A FUNCTION OF DAYS TO TRACHEOSTOMY

Figure 1: Inpatient mortality (adjusted odds ratio) with 95% confidence intervals as a function of days to tracheostomy. The 95% confidence intervals that do not cross 1 are statistically significant.

TOTAL VENT DAYS AND ADDITIONAL VENT DAYS AFTER TRACHEOSTOMY AS A FUNCTION OF DAYS TO TRACHEOSTOMY
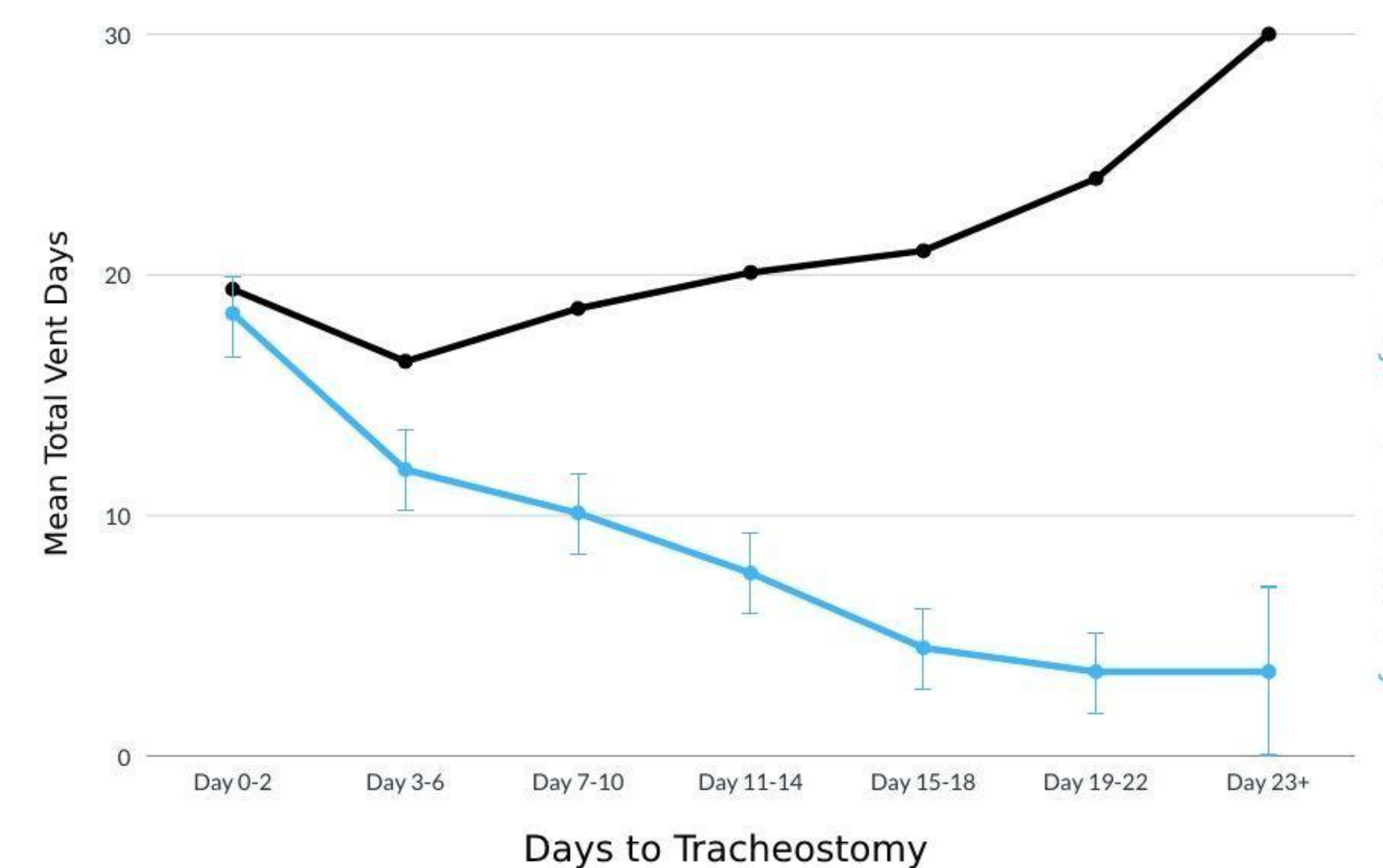
	Tracheostomy Days 0-10 After Intubation (Early) (N=150)	Tracheostomy Days 11+ After Intubation (Late) (N=245)	Endotracheal Intubation Only (N=5,516)
Inpatient Mortality Odds Ratio Adjusted Ratio *	44.7% 0.68 (0.49, 0.94) 0.73 (0.52, 1.01) *	33.1% 0.41 (0.32, 0.54) 0.44 (0.34, 0.58) *	54.4%
Ventilator Associated Pneumonia	6.7% 3.79 (1.94, 7.42)	11.8% 7.13 (4.62, 11.00)	1.9%
Pulmonary Embolism (PE)	0.0% <0.001 (<0.001, >999) <0.001 (<0.001, >999) *	0.0% <0.001 (<0.001, >999) <0.001 (<0.001, >999) *	0.05%
Acute Myocardial Infarction (MI)	6.0% 1.95 (0.98, 3.89) 2.06 (1.03, 4.13) *	4.9% 1.57 (0.86, 2.86) 1.68 (0.92, 3.08) *	3.2%
Cerebral Infarction (CVA)	10.7% 0.70 (0.42, 1.18) 0.72 (0.42, 1.23) *	13.1% 0.88 (0.60, 1.29) 0.82 (0.55, 1.22) *	14.6%
Acute Kidney Injury (AKI)	1.3% 0.99 (0.24, 4.09) 1.08 (0.26, 4.52) *	2.5% 1.85 (0.80 4.29) 1.94 (0.81, 4.62) *	1.3%
Acute Respiratory Distress Syndrome (ARDS)	72.0% 1.26 (0.88, 1.81) 1.39 (0.95, 2.02) *	72.7% 1.31 (0.98, 1.74) 1.34 (0.99, 1.82) *	67.0%
Ventilator Associated Pneumonia (VAP)	12.7% 0.91 (0.56, 1.48) 0.90 (0.55, 1.46) *	22.9% 1.86 (1.37, 2.53) 1.75 (1.28, 2.40) *	13.8%
Mean Hospital Length of Stay (HLOS) P-value Adjusted p-value *	31.6 (±16.7) <0.0001 <0.0001 *	38.4 (±16.3) <0.0001 <0.0001 *	16.4 (±13.0)
Mean Total Mechanical Ventilation Days (TMVD) P-value Adjusted p-value *	18.3 (±14.1) <0.0001 <0.0001 *	23.6 (±16.4) <0.0001 <0.0001 *	7.4 (±8.7)
Mean Additional Mechanical Ventilation Days After Tracheostomy (AMVD)	8.3-18.3	0-12.6	

Discussion

- While both early (<10 days) and late (>10 days) had lower overall mortality rate compared to control, inpatient mortality was only significantly lower in the late tracheostomy (>10 days) group (OR 0.44 95% CI 0.34, 0.58).
- Multiple studies have suggested that tracheostomy in actively infected COVID-19 patients is safe for patients and surgeons[2,3,4,5].
- Tracheostomy at 11 days or later is associated with overall lower inpatient mortality.
- Better survival, longer HLOS, and longer TMVD will predispose patients to competing risks; where patients who live longer will be more likely exposed to complications. This was seen in the tracheostomy cohort where they endured significantly more complications such as VAP, PE, MI, and ARDS.

Conclusion

- Tracheostomy in COVID-19 patients appears to be safe and may be associated with lower mortality.
- Our results suggest that the optimal timing for tracheostomy placement for COVID-19 patients is at 11 days or later.

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