Tracheostomy Timing in ICU Patients: A Systematic Review of Early Versus Late Tracheostomy

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BACKGROUND

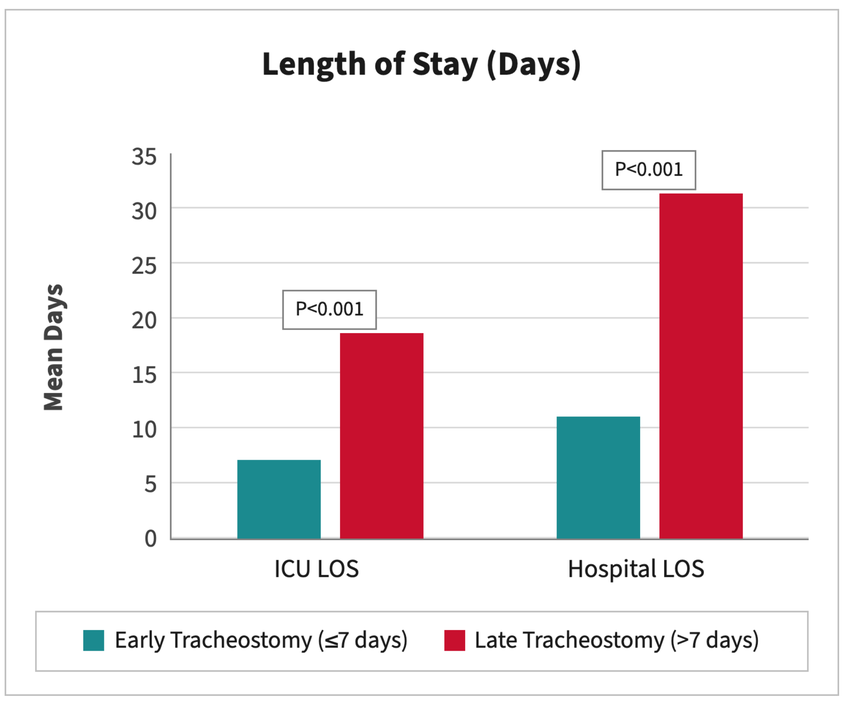
- Tracheostomy is common in critically ill patients who need prolonged mechanical ventilation
- Timing is a tradeoff: prolonged intubation risks laryngeal/tracheal injury and ventilator-associated pneumonia, while tracheostomy carries procedural and long-term risks (bleeding, infection, stenosis, impaired decannulation)
- There is conflicting evidence regarding how tracheostomy timing affects ICU and hospital length of stay, ventilator duration, and mortality
- Prior reviews focused on length of stay, mortality, and ventilator-associated pneumonia, and overlooked tracheostomy-specific outcomes (decannulation, stenosis, granuloma)
- **Aim:** compare early vs. late tracheostomy across general and tracheostomy-specific outcomes to guide timing decisions

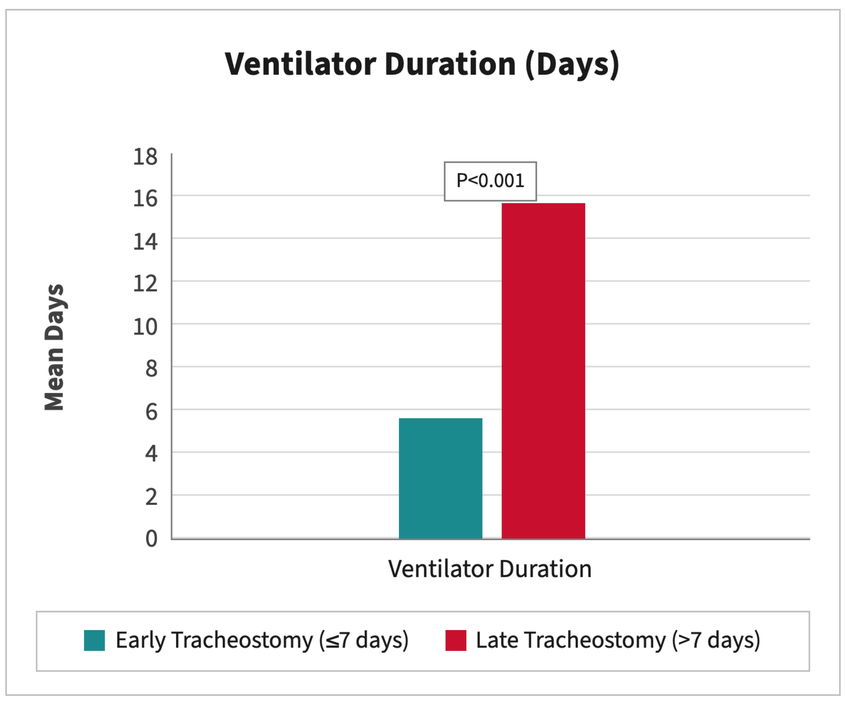
METHODS

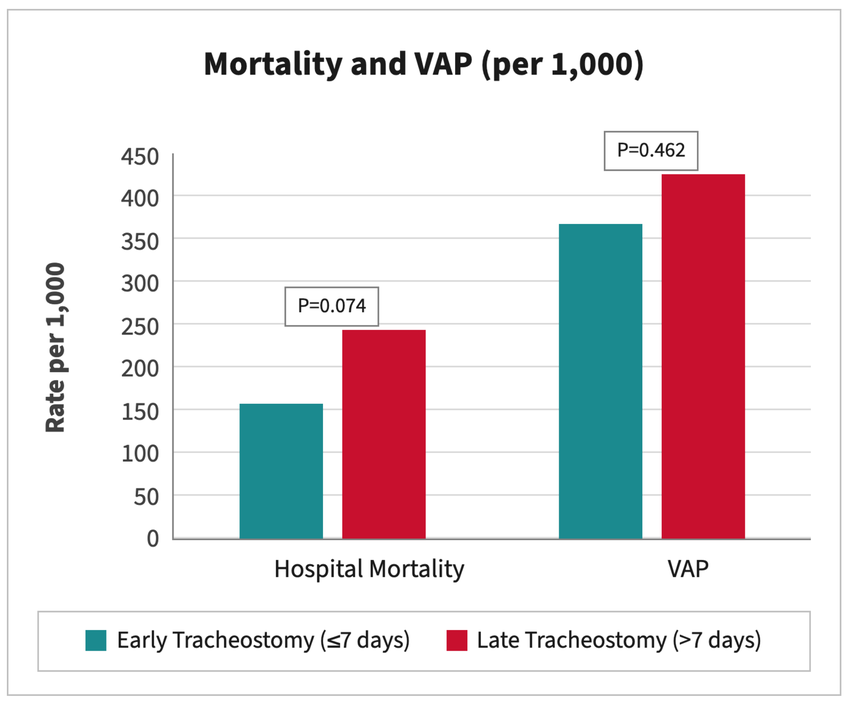
- **Design -** PRISMA-guided systematic review of PubMed and Scopus from inception to December 2025.
- **Population -** Critically ill adults (≥18 yrs) on prolonged mechanical ventilation; early tracheostomy (≤7 days) vs. late (>7 days) tracheostomy.
- **Study Designs -** RCTs, cohort, case-control, and observational studies; 58 studies (61 cohorts), 119,696 patients.
- **Outcomes -** ICU length of stay(LOS), hospital length of stay, ventilator duration, hospital mortality, ventilator-associated pneumonia (VAP), and decannulation.
- **Analysis -** Mann-Whitney U test (length of stay, ventilator duration, mortality); Welch's t-test (VAP)

RESULTS

- 58 studies; 61 cohorts
- 119,696 patients; Early tracheostomy (ET): 17,226; Late tracheostomy (LT): 102,470
- ET had significantly shorter mean ICU LOS (7.19 vs 18.67 days), hospital LOS (11.02 vs 31.40 days), and ventilator duration (5.59 vs 15.64 days), all $p<0.001$.
- Hospital mortality trended lower with ET (156.96/1000 vs 243.61/1,000; $p=0.074$).
- VAP rates were similar between groups (367.85 vs 425.34/1,000; $p=0.462$).
- Decannulation (6/61 cohorts) favored ET but was not pooled due to inconsistent reporting.
- Sensitivity analysis excluding overlapping data confirmed all primary findings.







DISCUSSION

- Early tracheostomy was associated with a more efficient ICU course: shorter stay and fewer ventilator days.
- No clear mortality benefit; two TBI studies found higher mortality with ET, possibly due to transient ICP elevation during tracheostomy.
- Similar VAP findings between groups may be due to heterogeneous definitions across studies (microbiologic vs. clinical criteria) and the CDC's shift to ventilator-associated event (VAE) surveillance in 2013
- Decannulation outcomes favored ET, but data could not be pooled due to inconsistent reporting.
- Standardized timing definitions and outcome reporting are needed.

CONCLUSION

- Early tracheostomy (≤7 days) is associated with significantly shorter ICU and hospital length of stay and fewer days of mechanical ventilation, though no clear mortality benefit was identified.
- These findings support consideration of tracheostomy within 7 days of intubation in critically ill patients.
- Future studies should adopt standardized timing definitions, consistently report tracheostomy-specific outcomes such as decannulation and stenosis, and examine timing in specific populations such as patients with TBI.

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References

1. Pierson DJ. Tracheostomy and weaning. *Respir Care*. 2005;50(4):526-533.]
2. Young D, Harrison DA, Cuthbertson BH, et al. Effect of early vs late tracheostomy placement on survival in patients receiving mechanical ventilation: the TracMan randomized trial. *JAMA*. 2013;309(20):2121-2129.
3. Rizk EB, Patel AS, Stetter CM, Chinchilli VM, Cockroft KM. Impact of tracheostomy timing on outcome after severe head injury. *Neurocrit Care*. 2011;15(3):481-489.]
4. Andriolo BN, Andriolo RB, Saconato H, Atallah ÁN, Valente O. Early versus late tracheostomy for critically ill patients. *Cochrane Database Syst Rev*. 2015;(1):CD007271.