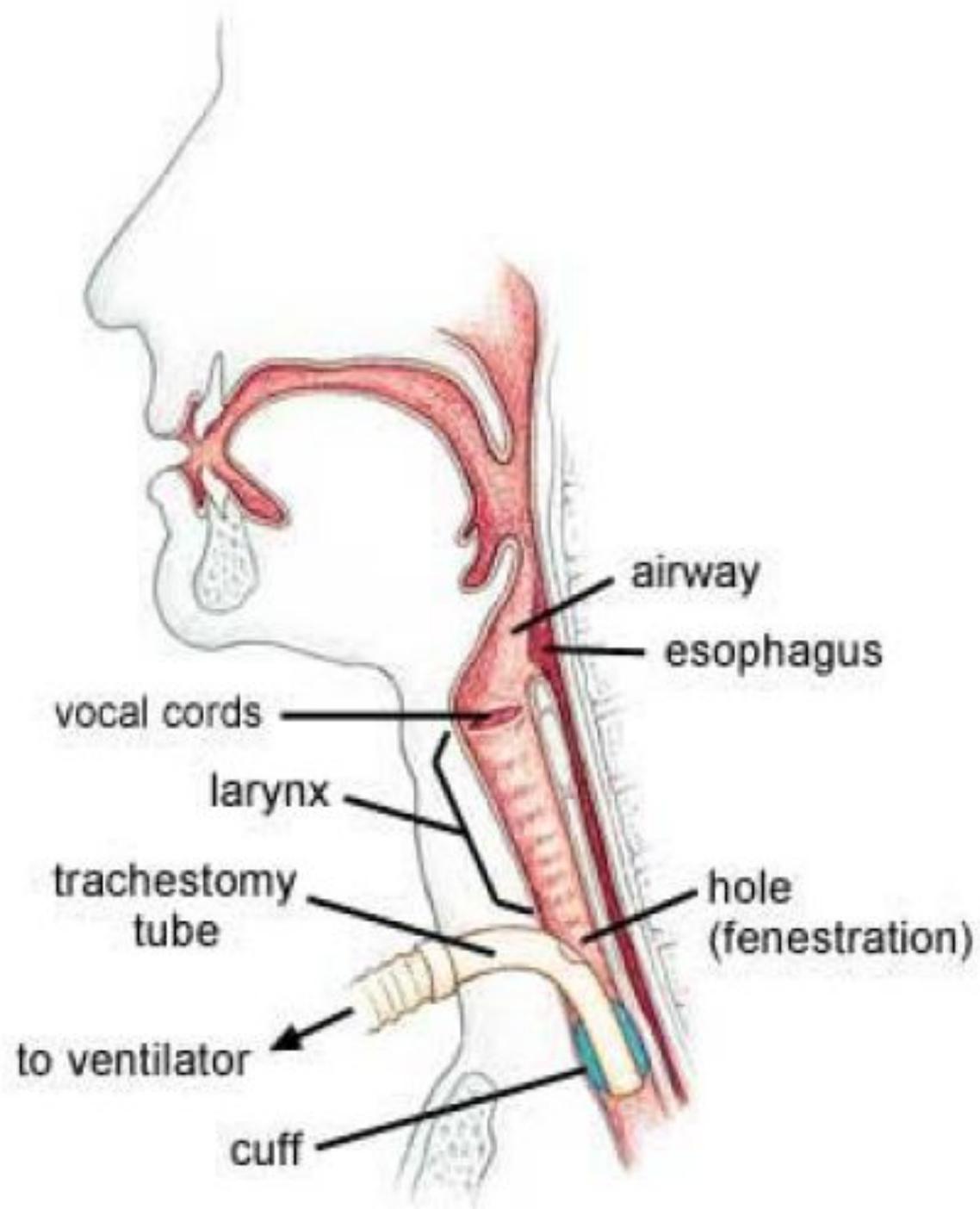


# Tracheostomy in pediatric

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1. History
  2. Indication
  3. Tracheostomy vs Tracheal intubation
  4. A systematic review
  5. Decannulation
  6. Swallowing
  7. Communication concerns
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# History

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- ▶ In the early and mid-19th century -a life-saving treatment for diphtheria patients
- ▶ By the early 1900s endotracheal intubation was popularized + the early 20th century, immunization for diphtheria and the introduction of sulfonamides
- ▶ In the 1930s → poliomyelitis→ in the 1950s→ “polio vaccine (Salk vaccine)”
- ▶ Tracheotomy - general anesthesia in the late 19th century
- ▶ Late 1970s → laryngotracheobronchitis and epiglottitis



# History

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- ▶ Since the 1960s and 1970s
- ▶ acute airway obstruction
- ▶ prolonged ventilation + management of chronic airway obstruction + pulmonary toilet



# INDICATIONS

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- ▶ Respiratory failure and anticipated need for prolonged ventilation
- ▶ Upper airway obstruction
- ▶ Providing access for pulmonary toilet



**TABLE  
92.2**

**TRACHEOTOMY VERSUS PROLONGED ENDOTRACHEAL INTUBATION**

**Tracheotomy**

**Prolonged Intubation**

**Advantages**

Shorter, larger tube can be placed  
Decreased airway dead space  
Less damage to larynx, including supraglottic, glottic, and subglottic regions  
More comfortable for the patient  
May allow child to be discharged from the hospital, even on a ventilator  
Care for the tracheostomy can be performed by trained caregivers/family who are not health care professionals

Can be performed by a variety of health care providers  
Does not require a surgical procedure and associated complications

**Disadvantages**

Requires an experienced surgeon  
Complications associated with tracheotomy (see Complications section)  
Requires a surgical procedure

Endotracheal tubes may be plugged easily  
Increased airway dead space  
More likely to cause damage to the larynx and trachea  
Less comfortable for the patient  
Care cannot be performed easily by patient/family caregivers



# Prolonged intubation

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- ▶ In adults → 14-21 days
- ▶ In infants and children, this time period can be prolonged with proper selection of endotracheal tube size. avoiding cuffed tubes or minimizing the pressure in the cuffs, and restricting movement on the tube.
- ▶ Newborns can tolerate longer periods of intubation (greater than 50 days) with a low risk of subglottic stenosis.

Lee W. Koltai P. Harrison AM, et al. Indications for tracheotomy in the pediatric intensive care unit population. *Arch Otolaryngol Head Neck Surg* 2002;128:1249-1252



# Timing of tracheostomy

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- ▶ The American National Association of Medical Directors of Respiratory Care in 1989 → 21 days
- ▶ Other authors recommended early tracheostomy

3. Plummer A, Gracey D (1989) Consensus conference on artificial airways in patients receiving mechanical ventilation. *Chest* 96(1):178–1780

4. Kane T, Rodriguez J, Luchette F (1997) Early versus late tracheostomy in the trauma patient. *Respir Care Clin* 3:1–20





## Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review

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### Abstract

The objective of this article is to evaluate the appropriate timing of tracheostomy in patients with prolonged intubation regarding the incidence of hospital-acquired pneumonia, mortality, length of stay in intensive care unit (ICU) and duration of artificial ventilation. The study included published articles yielded by a search concerning timing of tracheostomy in adult and pediatric patients with prolonged intubation. The search was limited to articles published in English language in the last 30 years (between 1987 and 2017). For the 690 relevant articles, we applied our inclusion and exclusion criteria and only 43 articles were included. 41 studies in the adult age group including 222,501 patients and 2 studies in pediatric age group including 140 patients met our criteria. Studies in adult age group were divided into three groups according to the methodology of determining the cut off timing for early tracheostomy, they were divided into studies that considered early tracheostomy within the first 7, 14 or 21 days of endotracheal intubation, while in pediatric age group the cut off timing for early tracheostomy was within the first 7 days of endotracheal intubation. There was a significant difference in favor of early tracheostomy in adults' three groups and pediatric age group as early tracheostomy was superior regarding reduced duration of mechanical ventilation, with less mortality rates and less duration of stay in ICU. Regarding hospital-acquired pneumonia, it was significantly less in adult groups but with no significant difference in pediatric age group (3 patients out of 72 pediatric patient with early tracheostomy had pneumonia compared to 11 patients out of 68 with late tracheostomy). Studies defining early tracheostomy as that done within 7 days of intubation had better results than those defining early tracheostomy as that done within 14 or 21 days of intubation. In conclusion, early tracheostomy within 7 days of intubation should be done for both adults and pediatric patients with prolonged intubation.

**Keywords** Early tracheostomy · Tracheostomy timing · Prolonged endotracheal intubation · Tracheostomy

# methods

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- ▶ 30 years (between 1987 and 2017)
- ▶ Prospective, randomized controlled studies
- ▶ Timing 7 – 14 – 21 days
- ▶ 41 studies included in adult age group with 222,501 patients and 2 studies included in pediatric age group with 140 patients
- ▶ Criteria
  - ▶ hospital-acquired pneumonia,
  - ▶ incidence of mortality,
  - ▶ duration of mechanical ventilation and length of ICU stay



# Result

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- ▶ **Adult patients**
  - ▶ incidence of hospital acquired pneumonia,
  - ▶ incidence of mortality,
  - ▶ duration on mechanical ventilation and length of stay in ICU



# Effect of early vs. late tracheostomy on clinical outcomes in critically ill pediatric patients

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▶ [J.-H. Lee](#) [C.-H. Koo](#) [S.-Y. Lee](#) [E.-H. Kim](#) [I.-K. Song](#) [H.-S. Kim](#) [C.-S. Kim](#) [J.-T. Kim](#)

▶ First published: 04 July 2016 <https://doi.org/10.1111/aas.12760>

## ▶ Abstract

## ▶ Background

▶ Few studies investigated the optimal timing for tracheostomy and its influence on the clinical outcomes in critically ill pediatric patients. This study evaluated the differences in clinical outcomes between early and late tracheostomy in pediatric intensive care unit (ICU) patients.

## ▶ Methods

▶ We assessed 111 pediatric patients. Patients who underwent a tracheostomy within 14 days of mechanical ventilation (MV) were assigned to the early tracheostomy group, whereas those who underwent tracheostomy after 14 days of MV were included in the late tracheostomy group. Clinical outcomes, including mortality, duration of MV, length of ICU and hospital stays, and incidence of ventilator-associated pneumonia (VAP) were compared between the groups.

## ▶ Results

▶ Of the 111 pediatric patients, 61 and 50 were included in the early and late tracheostomy groups, respectively. Total MV duration and the length of ICU and hospital stay were significantly longer in the late tracheostomy group than in the early tracheostomy group (all  $P < 0.01$ ). The VAP rate per 1000 ventilator days before tracheostomy was 2.6 and 3.8 in the early and late tracheostomy groups, respectively. There were no significant differences in mortality rate between the groups. No severe complications were associated with tracheostomy itself.

## ▶ Conclusions

▶ Tracheostomy performed within 14 days after the initiation of MV was associated with reduced duration of MV and length of ICU and hospital stay. Although there was no effect on mortality rate, children may benefit from early tracheostomy without severe complications.

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## Early tracheostomy improves outcomes in severely injured children and adolescents

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▶ [J Pediatr Surg](#). 2014 Apr;49(4):590-2. doi: 10.1016/j.jpedsurg.2013.09.002.

▶ [Holscher CM](#)<sup>1</sup>, [Stewart CL](#)<sup>2</sup>, [Peltz ED](#)<sup>3</sup>, [Burlew CC](#)<sup>4</sup>, [Moulton SL](#)<sup>5</sup>, [Haenel JB](#)<sup>3</sup>, [Bensard DD](#)<sup>6</sup>.

### ▶ [Author information](#)

### ▶ **Abstract**

### ▶ **BACKGROUND:**

▶ Early tracheostomy has been advocated for adult trauma patients to improve outcomes and resource utilization. We hypothesized that timing of tracheostomy for severely injured children would similarly impact outcomes.

### ▶ **METHODS:**

▶ Injured children undergoing tracheostomy over a 10-year period (2002-2012) were reviewed. Early tracheostomy was defined as post-injury day  $\leq 7$ . Data were compared using Student's t test, Pearson chi-squared test and Fisher exact test. Statistical significance was set at  $p < 0.05$  with 95% confidence intervals.

### ▶ **RESULTS:**

▶ During the 10-year study period, 91 patients underwent tracheostomy following injury. Twenty-nine (32%) patients were  $< 12$  years old; of these, 38% received early tracheostomy. Sixty-two (68%) patients were age 13 to 18; of these, 52% underwent early tracheostomy. Patients undergoing early tracheostomy had fewer ventilator days ( $p=0.003$ ), ICU days ( $p=0.003$ ), hospital days ( $p=0.046$ ), and tracheal complications ( $p=0.03$ ) compared to late tracheostomy. There was no difference in pneumonia ( $p=0.48$ ) between early and late tracheostomy.

### ▶ **CONCLUSION:**

▶ Children undergoing early tracheostomy had improved outcomes compared to those who underwent late tracheostomy. Early tracheostomy should be considered for the severely injured child.

### ▶ **SUMMARY:**

▶ Early tracheostomy is advocated for adult trauma patients to improve patient comfort and resource utilization. In a review of 91 pediatric trauma patients undergoing tracheostomy, those undergoing tracheostomy on post-injury day  $\leq 7$  had fewer ventilator days, ICU days, hospital days, and tracheal complications compared to those undergoing tracheostomy after post-injury day 7.

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# DECANNULATION

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- ▶ craniofacial abnormalities 63%
- ▶ prolonged intubation 47%
- ▶ neurologic impairment 12.5%

*Carron JD, Derkay CS, Strobe GL. et al. Pediatric tracheotomies: changing indications and outcomes. Laryngoscope 2000;110:1099-1104*

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# DECANNULATION

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- ▶ In a study of children who underwent tracheotomy in the first year of life, 36.3% of term infants and 30.6% of preterm infants were decannulated successfully
- ▶ 458 days for term infants and 736 days for preterm infants

*Wooten et al. French LC, Thomas RG, et al. Tracheotomy in the first year of life: outcomes in term infants, the Vanderbilt experience. Otolaryngol Head Neck Surg 2006;134:365-369*



# COMMUNICATION CONCERNS

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- ▶ Delay in speech acquisition
- ▶ Decreased receptive and expressive language skills

52. Hill BP, Singer II. Speech and language development after infant tracheostomy. *J Speech Hear Disord* 1990;55:15-20.

53. Jiang D, Morrison GA. The influence of long-term tracheostomy on speech and language development in children. *Int J Pediatr Otorhinolaryngol* 2003;67S1:S217-S220.

54. Kaslon WK, Stein RE. Chronic pediatric tracheostomy: assessment and implications for habilitation of voice, speech and language on young children. *Int J Pediatr Otorhinolaryngol* 1985;9:165-171.

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# SWALLOWING

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- ▶ Impair laryngeal elevation during swallowing
- ▶ Reduce cough effectiveness
- ▶ Esophageal obstruction

*Eibling DE, Gross RD. Subglottic air pressure: a key component of swallowing efficiency. Ann Otol Rhinol Laryngol 1996;105:253-238.*

*Gross RD, Mahlmann J, Grayhack JP. Physiologic effects of open and closed tracheostomy tubes on the pharyngeal swallow. Ann Otol Rhino! Laryngol 2003;112:143-152.*



# Conclusion

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- ▶ Early tracheostomy is associated with decreased duration of mechanical ventilation and length of stay in ICU but does not affect the incidence of hospital acquired pneumonia.
- ▶ There is no standard timing for tracheotomy after prolonged ventilation in children.
- ▶ Children who have a tracheostomy can have both impaired communication skills and abnormal swallowing function





2019

Happy New Year

*chiasetainguyen.com*

# References

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- ▶ Pediatric tracheostomy - *Jeffrey P. Simons – Bailey textbook*
- ▶ **Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review.** - [Adly A<sup>1</sup>](#), [Youssef TA<sup>2</sup>](#), [El-Begermy MM<sup>1</sup>](#), [Younis HM<sup>1</sup>](#). [Eur Arch Otorhinolaryngol.](#) 2018 Mar;275(3):679-690. doi: 10.1007/s00405-017-4838-7. Epub 2017 Dec 19.
- ▶ Holscher C, Stewart C, Peltz E et al (2014) Early tracheostomy improves outcomes in severely injured children and adolescents. *J Pediatr Surg* 49:590–592
- ▶ Lee J, Koo C, Lee S et al (2016) Effect of early vs. late tracheostomy on clinical outcomes in critically ill pediatric patients. *Acta Anaesthesiol Scand* 1281–1288

