Recent Update in Tracheostomy Care

Assit. Prof. Dr. Sermsri Santati
Ramathibodi School of Nursing
Tracheostomy in pediatric patients is a unique characteristics due to the greater technical difficulty and care, high morbidity and mortality than in the adult and account for high utilization of health care resources.
Revisits after pediatric tracheotomy: Airway concerns result in returns

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OBJECTIVE

Objective: Undertaking tracheotomy represents a medically vulnerable patient population, and understanding the reasons for revisiting the hospital setting following tracheotomy is critical for improving the quality of care for these patients. This study aims to investigate the incidence and characteristics of revisits following pediatric tracheotomy.

METHODS

Methods: Cross-sectional, population-based study using state databases. The State Inpatient Databases and State Emergency Department Databases for California, Florida, Iowa, and New York 2010–2011 were linked and examined for revisits (patients < 18.0 years) and corresponding subsequent 30-day post-discharge revisits. Demographic and descriptive data were analyzed determining the revisit rate, revisit diagnoses, procedures, and discharge dispositions.

RESULTS

Results: 2,248 pediatric tracheotomy cases were extracted (50.8% male, mean age 6.5 years). There were 373 inpatient or emergency department revisits (30-day revisit rate, 16.6%) of which 34.3% occurred within 48 h after discharge. Of these, 59.2% were inpatient readmissions. There were ≤10 deaths during these revisits (30-day revisit mortality rate ≤0.7%). The most common primary revisit diagnoses were "fistula/occult/foreign body," "infants in respiratory failure," "infant with stridor," "laryngeal obstruction," and "respiratory failure." The most common revisit procedures were tube exchange (12.4%), mechanical ventilation (8.8%), and replacement of tracheotomy tube (3.7%). Children discharged to a skilled care facility (47.3%) were more likely to have a revisit rate (52.0%) to have a revisit (21.3% versus 12.9%, respectively; p = 0.001).

Conclusions: Children undergoing tracheotomy have a substantial 30-day revisit rate, most notably during the first 48 h after discharge, often involving tracheotomy tube or pulmonary complications. Improvements in discharge planning should target prevention of these complications.

1. Introduction

Pediatric tracheotomy is a relatively common procedure performed at tertiary care institutions, with more than 4800 performed annually in the United States alone (1). Tracheotomy is currently performed for children with upper airway anomalies, the need for prolonged mechanical ventilation, or significant complex morbidities such as neurologic impairment or chronic lung disease (2–4). In the pre-atomic era, pediatric tracheotomies were primarily performed for acute infections such as diphtheria, croup, and epiglottitis, with relatively shorter time to decannulation. The shift in modern preventive therapies is paralleled by a rise in long-term tracheotomies performed amongst premature infants, as well as older infants and children with chronic medical conditions (5,6). Infants and children with chronic medical conditions are afforded longer survival as a result of improved multidisciplinary medical and surgical care. Particularly for infants and children requiring prolonged mechanical ventilation, tracheotomy placement is an important step towards hospital discharge. Despite advances in short- and long-term care, pediatric tracheotomy is still associated with significant postoperative complications, with estimates in the literature ranging from 24.3 to 66.0% (6,7). In the early postoperative period, these complications include hoarse voice, vocal cord edema, tracheitis, stomal granulation, and local wound breakdown. Very little is known about tracheotomy-related complications following hospital discharge. Mahida et al. (6) recently reported that for children under the age of 2 years, pneumonia (7.7%), sepsis (2.3%), death (3.6%), and deep or organ space surgical infection (4.6%) were the common complications following hospital discharge.

Articles published in last 3 decades (1985-2014) were reviewed.

47 out of 3797 articles were chosen.

Most common complications:
- Granuloma
- Infection
- Obstruction
- Accidental decannulation
- Fistula
- Mortality 0-5.9%
Pseudomonas aeruginosa and post-tracheotomy bacterial respiratory tract infection readmissions

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Abstract
Objectives: Identify risk factors for readmission due to a bacterial tracheostomy-associated respiratory tract infection (bTART) within 12 months of discharge after tracheotomy.

Design/Methods: We performed a retrospective cohort study of 240 children who underwent tracheotomy and were discharged with tracheostomy in place between January 1, 2005, and June 30, 2013. Children with prolonged fistuolar post-tracheotomy length of stay (LOS), less than 12 months of follow-up, or who died during the index hospitalization were excluded. Readmission for a bTART (pneumonia, tracheitis) treated with antibiotics, as ascertained by manual chart review, was the outcome variable. We used multivariate logistic regression to identify the independent association between risk factors and hospital readmission for bTART within 12 months.

Results: Of the index hospitalizations for tracheostomy, the median admission age was 5 months (interquartile range [IQR] 2.4-12 months) and median LOS was 73 days (IQR 43-121 days). Most patients were of Hispanic ethnicity (n = 167, 68%) and were publicly insured (n = 213, 88%). Nearly half (n = 112, 47%) were discharged on positive pressure mechanical ventilation. Many (n = 103, 43%) were admitted for bTART within 12 months of discharge. Only Hispanic ethnicity (adjusted odds ratio [AOR] 2.0; 95% confidence interval [CI]: 1.1-3.7; P = 0.03) and acquisition of Pseudomonas aeruginosa during tracheostomy and discharge from index hospitalization (AOR 3.2; 95%CI: 1.2-8.3; P = 0.02) were independently associated with increased odds of bTART readmission, while discharge on gastrointestinal pro-mobility agents was associated with decreased risk (AOR = 0.4; 95%CI: 0.2-0.8; P = 0.01).

Conclusions: Hispanic ethnicity and post-tracheostomy acquisition of P. aeruginosa during initial hospitalization are associated with bTART readmission.

Keywords:
- bacterial, child, hospitalized, pediatric, pneumonia, readmission, tracheitis

1 INTRODUCTION

Hospitalizations in pediatric patients with pre-existing tracheostomy amounted to $1.4 billion in hospital charges in 2012.1 Of these hospitalizations, bacterial pneumonia is the most common ambulatory care-sensitive condition (conditions for which appropriate ambulatory care prevents or reduces admission to the hospital) requiring hospitalization.2 Previous research has shown that the wide diagnostic and therapeutic variations of pediatric patients hospitalized with bacterial tracheostomy-associated respiratory tract infections (bTARTs) are not associated with length of stay (LOS) or readmission.3 Because children with tracheostomy account for high utilization of health care resources,2-5 identification of high-risk subpopulations, and modifiable factors may assist in development of evidence-based best practices for the prevention and treatment of these infections, and decrease hospital admissions and healthcare expenditures.

Children with tracheostomy tube
from Division of Pediatric Respiratory Diseases, Ramathibodi Hospital
during 2000-2018

Compare with 4 other hospitals

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<th>Year</th>
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Cause of tracheostomy intubation
from Division of Pediatric Respiratory Diseases, Ramathibodi Hospital

- Respiratory failure
- Prolonged mechanical ventilation
- Upper airway anomalies
- Removal of respiratory secretions
- Protect risk of aspiration
Complications

- Death
- Decannular >> Hypoxia
- Injuries >> granulation
- Infection & Atelectasis

Division of Pediatric Respiratory Diseases, Ramathibodi Hospital, 2018.
Care of the Child with a Chronic Tracheostomy

This official statement of the American Thoracic Society was adopted by the ATS Board of Directors, July 1999

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- Suctioning
- Humidification
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- Decannulation Procedures
- Complications
- Areas of Suggested Research
A respiratory therapist presents 10 important things to consider when performing endotracheal suctioning, including depth of catheter insertion, suction catheter size, and more.

Michael Hahn, RPFT, RRT-NPS
suctioning is a vital component of management for a child with a tracheostomy. Techniques of suctioning are designed to efficiently clear the airway of mucus while avoiding the potential hazards of suctioning.
The **"premeasured technique"** involves the use of a catheter with side holes close to the distal end (0.5 cm or less) and inserted just exiting the tip of the tracheostomy tube.

**"Deep suctioning"** insert the catheter until resistance is met, withdrawing the catheter slightly before suction is applied.

**exact depth in the premeasured technique is critical to avoid epithelial damage.**
Consensus:

a. The **premeasured technique** is **recommended** for all routine suctioning. **

b. Twirling the catheter between the fingers and thumb to make more easily to inserted, and easy to suct the secretions off all areas of the tube wall.

c. The use of premarked catheters is strongly recommended to ensure insertion to the proper depth.

d. Special circumstances may necessitate the occasional use of deep suctioning, but this increases the risk of epithelial damage. **

**
Frequency of Suctioning

Suctioning *as needed* is most frequently recommended. The frequency of suctioning will vary on the basis of individual. Suctioning allows the caregiver to assess tube patency. This is important because tubes can become obstructed without clinical symptoms.

**Consensus:**

a. Suctioning should be done on the basis of clinical assessment.

b. In children with no evidence of secretions, a minimum of suctioning, at morning and bedtime, to check for patency of the tube is recommended.
Bag Ventilation

Stable child with a tracheostomy and no additional resp. support do not receive hyperoxygenation, hyperinflation, or hyperventilation before suctioning. The primary concern is that secretions may be forced down the trachea and the more distal airways. The use of postsuctioning breaths varies.

Consensus:

An initial pass of catheter should be made to clear the tube before hyperinflation or hyperoxygenation are delivered. Patients receiving supplemental oxygen should be evaluated for the need of hyperoxygenation**. The patient's need for postsuctioning oxygenation or bag ventilation is best determined in the hospital before discharge. End tidal CO2 measurement and oxygen saturations can guide decision making.
Saline Instillation

The routine use of NSI may be associated with undesirable outcomes such as a decrease in oxygen saturation, an inability to mix with mucus, and contamination of the lower airways. Maintenance of adequate humidification will be more successful in maintaining thin mucus than NSI.

Consensus

The routine instillation of normal saline is not recommended.
Suction Catheter Size

Suction catheter size that is one-half the internal diameter of the tracheostomy tube is recommended. Another consideration in choosing a catheter is the ability to remove secretions adequately.

Consensus

The largest size catheter is recommended because it will remove secretions more efficiently. Atelectasis is not as likely with the rapid, premeasured technique.
Duration of Suctioning

Limiting deep suctioning to 15 s or less and the premeasured technique to 5 s or less.

Consensus

A rapid technique that is less than 5 s is recommended. This is vital when using a large suction catheter, relative to the tracheostomy tube size, to prevent atelectasis.
Suction Pressure

Pressures of 80 to 100 mmHg are typically used for pediatric patients.

Consensus

Suction should be applied both while inserting and removing the catheter.
Tracheal Suctioning in Children With Chronic Tracheostomies: A Pilot Study Applying Suction Both While Inserting and Removing the Catheter

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CHOC Children’s Hospital, Orange, CA

Key words: Tracheostomy; Suction; Tracheal; Tracheostomy

This pilot study compared two methods of tracheal suctioning in the same 13 children with chronic tracheostomies. Use of the American Thoracic Society (ATS) recommendations resulted in a significant increase in secretions obtained (r = −3.96; p < 0.001) when compared with traditional practice. The ATS-recommended method was also more efficient in children with secretions. When used first, no additional secretions were obtained after 90 minutes using the traditional method. Additional secretions were obtained with the ATS-recommended method when the traditional method was used first. Heart rate and oxygen saturation immediately and 1 minute after suctioning were not significantly different between methods.

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CHILDREN WHO HAVE critical airway obstruction caused by an underlying chronic condition may require a tracheostomy to maintain their airway. These tracheostomies may be required for months to years (Lewis, Carson, Perkins, Sie, & Foushee, 2003). Suctioning is a necessary part of tracheostomy care to maintain a patent airway. The goal of tracheal suctioning is maximal secretion removal with minimal hypoxia and tissue damage (Sherman, 2000; Bond, 2003; Carroll, 1994). If suctioning is performed improperly, it can cause complications such as hypoxia, aneurectasis, bradycardia, trauma, and infection (Bagliss, 1999).

Background

Wittmer, Thompson, March, and Tom (1999), in a retrospective review of records for 450 tracheostomies in children at their institution, identified that more than half (53%) were required for chronic ventilation. Research and protocol development for children with chronic tracheostomies are sparse. In 1993, the American Association for Respiratory Care (AARC) published their “Clinical practice guideline: Endotracheal suctioning of mechanically ventilated adults and children with artificial airways.” Their recommendation was that negative pressure should be applied as the catheter is withdrawn. No additional guidelines regarding suctioning in children with chronic tracheostomies were provided.

To address the need, the ATS published their official guideline statement on “Care of the child with a chronic tracheostomy” in 2000. ATS recommendations were made by a consensus of experts since no published standards and minimal research were found for this population. The only information available in the literature was based on the assumption that the patient was critically ill and had an artificial airway. The suctioning practices recommended by the ATS for children with chronic tracheostomies are summarized in Table 1. The practices are meant to be used in their entirety: they are not intended for children requiring nasotracheal (NT) or orotracheal (OT) suctioning.

Wilson (2005) cited ATS guidelines related to not instilling saline routinely prior to suctioning but differed...
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Note: HR = heart rate.
Pediatric tracheostomy care: What home care nurses need to know

Learn about evidence-based practices that help ensure safe care.

By Deborah S. Boroughs, MSN, RN, and Joan M. Dougherty, BSN, RN, CPN, CSN

Children with tracheostomy tubes can benefit from home care but require specialized nursing to prevent complications and emergencies. The artificial airway increases risk, especially in children with upper airway disorders. To provide safe and effective care, home care nurses must be skilled in respiratory assessment, routine tracheostomy management, and tracheostomy emergency response. They also need to apply proven strategies that help prevent complications and must be prepared to respond effectively to tracheostomy-related emergencies.

If you’re caring for a child with a tracheostomy, make sure you know the reasons for the tracheostomy and the status of the child’s upper airway. Children commonly require tracheostomies to bypass airway obstructions or to allow chronic mechanical ventilation. Airway obstruction may stem from trauma, tumors, infections, or structural abnormalities. Neurologic or neuromuscular disorders put children with weak gag reflexes at risk for choking and aspiration, and progressive muscular weakness or degeneration may hamper their ability to breathe. These children may need tracheostomies to manage secretions, avoid aspiration, and allow mechanical ventilation. Premature infants and children with chronic lung disease may need tracheostomies for long-term mechanical ventilation.

Evidence-based tracheostomy management

The American Thoracic Society (ATS) and the American Academy of Otolaryngology (AAO) have published guidelines for tracheostomy management. Supported by nursing research, these guidelines replace harmful traditions with safe, effective practices. Two primary evidence-based practice changes are safer, more effective suctioning and discontinuation of saline instillation into the tracheostomy tube.

Suction pressure recommendations

The following tracheostomy suction pressures are based on evidence:
- Neonates: 40 to 60 mm Hg
- Infants and children: 60 to 100 mm Hg
- Adolescents: 80 to 120 mm Hg

Safer suctioning

Current nursing and respiratory...
Tracheostomy emergencies in the home: How to intervene

The four most common pediatric tracheostomy emergencies are accidental decannulation, difficult tracheostomy tube insertion, mucus plug, and water in the tube.

Accidental decannulation
Accidental decannulation of the tracheostomy tube may occur if trach ties are loose, trach sponges are too thick, the child pulls at the tube, or ventilator tubing isn’t secured. If this emergency occurs, use this stepped approach:
1. Loosen trach ties.
2. Hyperextend the child’s neck.
3. Insert the same tracheostomy tube.
4. Attach a resuscitation bag to the tube to deliver breaths and confirm tube placement.
5. Secure the ties.
6. Perform a respiratory assessment.
7. Monitor and document the child’s response.

Difficult tube insertion
This may occur if airway growths (granulomas or papillomas), tracheomalacia (soft-tissue collapse), or tracheal stenosis develop; the stoma is scarred, distorted, or obstructed by granulation tissue; or the stoma is hard to visualize. When inserting a tracheostomy tube, always use an obturator. Liberally coat the tube’s exterior with water-based lubricant before insertion. Use this stepped approach:
1. Confirm the child is connected to pulse oximetry.
2. Hyperextend the child’s neck to visualize the stoma.
3. Attempt tube reinsertion.
4. If the attempt fails, insert a tube that’s a half-size smaller.
5. If you’re unable to insert a smaller tube, call 911.
6. If the child has a functional, open upper airway, cover the stoma with gauze and administer manual breaths via face mask attached to a resuscitation bag.
7. If the child lacks a functional upper airway and is breathing through the stoma, closely monitor his or her respiratory status while awaiting emergency help.
8. If the child stops breathing, deliver mouth-to-stoma breaths until emergency help arrives.

Know that if the child loses consciousness at any time, muscles around the stoma and in the airway will relax, which may allow reinsertion of the tube. Once the tube is inserted successfully, closely monitor the child’s respiratory status.

Mucus plug
Inadequate humidification, dehydration, and infection may lead to mucus plug formation. Here’s a stepped approach to take in this emergency:
1. If copious secretions are visible, suction the child. Otherwise, go directly to step 2.
2. “When in doubt, take it out.” Perform an emergency tracheostomy change if the child is in respiratory distress.
3. Attach a pulse oximeter to the child and perform respiratory assessment.
4. Administer supplemental oxygen if available and needed.

Water in the tube
Water may enter the tracheostomy tube if excessive water builds up from the humidification system or from swimming, water play, or bathing. To deal with this emergency, use this stepped approach:
1. Suction the child.
2. Place the child on pulse oximetry and assess respiratory status.
3. Administer oxygen.
4. Use the child’s assistive coughing device as prescribed.
5. Administer prescribed respiratory treatment as needed.
6. Perform a respiratory assessment and monitor the child continuously until he or she returns to respiratory baseline status.
Conclusion

ATS & groups of expert’s recommendations for tracheostomy tube suctioning

- Catheter size – ½ of trach. diameter, or large enough to pass trach. tube
- Suction depth – not further than tip of trach. tube
- Hole on side to clear trach. wall
- Pressure – 80-100 mmHg. In children
- Duration – 5 sec. for premeasured technique, suction both in and out
- Saline instillation – NO!!
Ideal tracheostomy suction catheter

- Variety size that has ½ of trach. diam.
- No longer than the tip of trach.
- Holes on side ~ 0.5 cm. from tip
- Soft material with curve at the tip
- Easy to use esp. for home care & re-usable
Variety size that has ½ of trach diam.

No longer than the tip of trach.

Holes on side ~ 0.5 cm. from tip

Soft material with curve at the tip

Easy to use esp. for home care & re-usable
MU Trach. Sucker
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