Pediatric Tracheostomy: Care & Crisis Management

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Pediatric Tracheostomy Symposium
Overview

• Pediatric Tracheostomy Care
  • Tracheostomy Overview
  • Changing of the Tracheostomy Tube
  • Suctioning

• Tracheostomy Crises
  • Intraoperative
  • Early Post-Operative
  • Late Post-Operative
Objectives

• Improve care of pediatric patients with tracheostomies

• Increase identification of patients at higher risk for tracheostomy complications

• Enhance assessment and management of critical airway situations in patients with tracheostomies
Tracheostomy Care

Suction of a Tracheostomy Tube

Catheter

Suction valve

http://www.allinahealth.org/mdex/ND7101G.HTM
Pediatric Tracheostomy

- Peak Incidence: < 1 y.o.
- Indications
  - Ventilator dependency
  - Airway obstruction
  - Pulmonary toilet

Lymphangioma

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Tracheostomy Anatomy
Components – Single Lumen

Bivona

http://www.tracheostomy.com/faq/types.htm
Bivona

Cuffed

Flextend

http://www.indiamart.com/davabazaaronline/hospital-surgical.html

http://www.tracheostomy.com/faq/types.htm
Components – Inner/Outer Cannula

Shiley Tracheostomy Tubes are MRI Compatible
Shiley Uncuffed

Obturator
Components

Figure 1

A typical cuffed tracheostomy tube. The trach tube is held in place with tube ties that go around your neck.

Figure 2a: Outer Cannula

Figure 2b: Inner Cannula
## Tracheostomy Tube Sizing

<table>
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<tr>
<th>Age</th>
<th>Inner Diameter (mm)</th>
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<tr>
<td>Premature, &lt;1000g</td>
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<tr>
<td>Premature, 1000-2500g</td>
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<td>Neonate – 6 m.o.</td>
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<td>6 m.o. – 12 m.o.</td>
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<td>1 – 2 y.o.</td>
<td>4.0 – 5.0</td>
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<tr>
<td>&gt; 2 y.o.</td>
<td><strong>Age in years + 16</strong>&lt;br&gt;4</td>
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# Bivona Measurements

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Cincinnati Airway Card App
Care

- Humidification
- Suctioning
- Tracheostomy Tube Change
- Skin Care
- Cuff Management
Humidification

Disposable Heat & Moisture Exchanger (HME)

Trach Mask for Sleep


http://www.tracheostomy.com/care/humid.htm
Suctioning

How to Suction a Tracheostomy Tube

1. Connect the catheter to the suction machine. Do not touch the end of the catheter that will go into the trach tube.

2. Insert the catheter the proper distance into the trach tube (usually the length of the trach tube plus 1/4 inch.)

3. Apply suction by putting your thumb over the hole in the catheter while you gently pull the catheter back out. Gently roll the catheter between your thumb and forefinger as you pull the catheter out.

Tracheostomy Change

- Fresh Tracheostomy Tube with Obturator
- ½ Size Smaller Tracheostomy Tube with Obturator
- Trach Ties (Pre-Cut)
- Lubricant
- Suction Catheters and Suction Machine
- Sterile Gloves
- Scissors
- Excellent Lighting & Shoulder Roll
- Ambu-bag and/or Oxygen
Tracheostomy Change

- Place child on a firm, flat surface with shoulder roll
- Pre-cut new ties
- Suction old trach
- Place obturator in new trach
- Lubricate new trach
- **Hold onto old trach** while removing old ties
- Remove old trach
- Insert new trach in smooth, down and inward curved arc
- Remove obturator immediately
- **Do NOT let go of trach**
- Secure new ties
Tracheostomy Change

- Removing Old Trach Tube
- Inserting New Trach Tube
- Secure Trach Ties

Tie Placement

Procedure

- **Always Hold Trach Tube While Changing Tie**
- Change 1 side at a time
- Insert 1 end through faceplate, then other end
- Bring ties around neck & secure
- Tighten to 1 finger breadth
Tie Placement

Velcro Tie

1 Finger Space
Skin Management

- Keep peristomal area clean and dry
- Padding
  - Mepilex
  - Foam Sponge
  - Gauze
- Medications – PRN
  - Antifungal Ointment
  - Antibacterial Ointment
  - Silvadene Cream

http://careforanabella.blogspot.com/2010/09/september-16-day-76.html

http://www.greatmedicalsupplies.com/supply~Pepper+Medical+(OZ)
Cuff Pressure Measurement

Aim for **Minimal Occluding Volume**
Complication & Crisis Management
Morbidity & Mortality

- **Morbidity – Timing and Incidence**
  - Intraoperative: 3.3%
  - Early Post-Operative: 13.3%
  - Late Post-Operative: 38.3%

- **Mortality**
  - 1-2%
Intraoperative Code

- **Neo-Natal Intensive Care Unit (NICU)**
  - 1 day old Amish female with Pierre Robin Sequence
  - Failed intubation
  - Bedside tracheostomy

- **Operating Room (OR)**
  - Oxygen saturations drop
  - Significant bradycardia
A, B, C’s

Secure the airway

- Continued trying to ventilate via tracheostomy tube
- Rigid Bronchoscopy from above

Endoscopic View
Patient Deteriorating

- O2 saturation plummeting
- Worsening bradycardia
- Increased resistance to ventilation
Respiratory Distress in a Tracheostomy Patient

- **Differential Diagnosis Mnemonic:**
  - **D** – Displaced
    - Extruded Tracheostomy Tube
    - False Passage of Tracheostomy Tube
  - **O** – Obstructed
  - **P** – Pneumothorax
  - **E** – Equipment
What do you do?

- Needle decompression of Pneumothorax (PTX)
  - Patient starts to improve
- Confirm with Chest X-ray (CXR)
- Chest Tubes

Intraoperative Complications

- Hemorrhage
- Air Entry
- Cardio-Pulmonary Arrest
- Esophageal Injury
Hemorrhage

• **Incidence**
  - Most common intraoperative complication

• **Risk Factors**
  - Bleeding Diathesis
  - Cardiovascular Anomalies
  - Anterior location of Inferior Thyroid Vein
Hemorrhage

- Management
  - Electrocautery
  - Ligature ties
  - Gelfoam packing
- Avoidance
  - Pre-op coagulation profile
  - Limited dissection & meticulous hemostasis
Air Entry

- **Spectrum**
  - Subcutaneous Emphysema
  - PTX
  - Pneumomediastinum

- **Pathophysiology**
  - Dissection
  - Aggressive Ventilation
  - Laceration of Pleural Dome
Air Entry

- Diagnosis
  - CXR

- Avoidance
  - Intubate & Sedate patient
  - Minimize dissection

Air Entry Management

- Subcutaneous Emphysema
  - Observation
- PTX
  - Needle Decompression
  - Chest Tube
- Pneumomediastinum
  - Observation

Tension PTX

http://emedicine.medscape.com/article/1003552-overview
Cardio-Pulmonary Arrest

- Rapid washout of retained CO₂
- Cardiac Arrhythmia
- Hypotension
- Cardio-pulmonary arrest
Early Post-Op Complications

- Accidental decannulation
- Tracheostomy obstruction
  - Plugs
  - Peristomal Granulation Tissue
  - Positional obstruction
- Infection
- Pulmonary Edema

Positional Obstruction Risk

Plug

- **Most common** early post-operative complication

- **Avoidance**
  - Humidification
  - Meticulous trach care: suctioning (not too deep)
  - Prompt diagnosis of tracheobronchitis

http://www.fairview.org/healthlibrary/Article/116814EN

Plug

• Management
  • Suction with saline
  • Tracheostomy tube change
  • Supplemental Oxygen
  • Antibiotics PRN
Granulation Tissue

- **Peristomal Granulation Tissue**
  - Early or Late
  - May impede trach changes
  - Treat with Silver Nitrate topically
  - Silvadene cream for prevention
Case #2

- 15 y.o. female with history of massive facial trauma
- Intubation x 1 week prior to tracheostomy
- POD #5 Tracheostomy and Facial Fracture repair
  - Mandibular Maxillary Fixation
- Weaned from ventilator

http://www.anilagrawal.com/ij/vol_010_no_002/reviews/th/page003.html
Case #2 – Code

- Desaturation not responding well despite RN bagging with 100% O2
- Significantly increased work of breathing
- Tachycardic to 140 bpm
- Oozing around the tracheostomy tube
What do you do?

- Differential Diagnosis
  - DOPE
    - Displacement
      - Assessment of Tracheostomy Tube
        - Tracheostomy tube appears to be partly extruded
Case #2 – Management

- Attempt to replace tracheostomy tube
  - Obturator
  - Stay sutures
    - Stay sutures break
      - Cannot pass tracheostomy tube
Next Step?

- Seldinger Technique
  - Suction Catheter
  - Small Flexible Fiberoptic Endoscope
- Confirm placement with Flexible Endoscopy
Accidental Decannulation

- **Incidence**
  - 3.3 – 5.6 %

- **Diagnosis**
  - Desaturations
  - Extruded Tracheostomy Tube
  - Risk factor for False Passage

http://1.bp.blogspot.com/-auPB13gKxA/TazCi9Z5jyI/AAAAAAAACIs/Nxfkqoi1tIs/s1600/2011_0409%2528141%2529.JPG
False Passage

http://www.ghorayeb.com/TRACHEOTOMYtubeFALSEpassage.html
Accidental Decannulation

- **Avoidance**
  - Stoma maturation
  - Stay sutures
  - Tracheostomy ties
  - 1\textsuperscript{st} tracheostomy tube change on POD 5-7

http://www.tracheostomy.com/images/surgery/trach.jpg
4 Quadrant Maturation
Accidental Decannulation

- **Management**
  - Replace tracheostomy tube
    - Smaller tube or ETT
    - Seldinger technique
  - Intubate from above*
    - *If possible
Seldinger

a. Insertion of suction catheter through tracheostomy tube

b. Insertion of suction catheter through stoma into airway

c. Placement of tracheostomy tube in airway

d. Tracheostomy tube in airway

http://www.tracheostomy.com/care/change.htm
Case #2 Continues

• Initial Improvement
  • On ventilator

• Now desaturating again

• What do you do?
  • A, B, C’s
    • Check Tracheostomy Tube Placement
      • Endoscopy reveals pink, frothy fluid
        • Diagnosis?
Pulmonary Edema

- Incidence and Timing
  - Rare
  - Post-Obstructive Pulmonary Edema – 2 types
    - Early Post-Tracheostomy Complication
      - Usually occurs within 1 – 6 hours post-op
      - May occur after trach occlusion or dislodgement
Pulmonary Edema

- **Risk Factors**
  - Chronic Obstruction
  - Excessive Hand Ventilation

- **Diagnosis**
  - Endoscopy
  - CXR

- **Management**
  - Positive Pressure Ventilation
  - 100% Oxygen

Late Complications

- Foreign Body Aspiration
- Suprastomal Collapse & Tracheal Stenosis
- Persistent Tracheocutaneous (TC) Fistula
- Tracheoesophageal Fistula (TEF)
- Obstructing Granuloma & Fibroma
- Tracheoinnominate Fistula (TIF)
Foreign Body Aspiration

- Early or Late Complication

- Risk Factors
  - Age 1 – 3 y.o.
  - Siblings
  - Daycare

- Management
  - Call 911
  - Provide Respiratory Support

Fractured Inner Cannula

http://www.onlinejets.org/viewimage.asp?img=JEmergTraumaShock_2012_5_1_97_93098_u1.jpg
Case #3

- 2 y.o. female with multiple congenital anomalies
- Tracheostomy x 1 year for ventilator dependence
- Hospitalized for pneumonia
- Initially stabilized
- Now desaturating
  - Increased work of breathing
Now what do you do?

- **Differential Diagnosis**
- **Assessment**
  - Tracheostomy tube not displaced
  - No significant bleeding
  - Able to hand ventilate with significant pressure
  - Difficulty passing suction catheter
  - CXR reveals hyperinflation of lungs
CXR
Obstructing Granuloma

Flexible Fiberoptic Endoscopy

Findings

- Most common tracheal lesions occur at stoma
- Collapse of anterior tracheal wall just superior to tube
- Mild Bleeding

http://omicsonline.org/scientific-reports/images/srep630-g003.html
Obstructing Granuloma

• **Diagnosis**
  • **Endoscopy**
    • Bedside: Reveals obstruction
    • OR: Bronchoscopy before decannulation

• **CXR**
  • Hyperinflation of lungs
CXR

http://www.docstoc.com/docs/27602091/Interpretation-of-the-chest-x-ray-is
Obstructing Granuloma

- Management
  - Change tracheostomy tube length
  - Endoscopic forceps removal
  - Use endoscope to guide skin hook through stoma -> scissors, cautery
  - 1 stage LTR for anterior tracheal wall collapse
Case #4

- 15 y.o. male with Duchenne Muscular Dystrophy presented with respiratory distress
  - Wheel chair bound, severe scoliosis, and severe deconditioning
  - Tracheostomy performed

- 6 months later RT noted bleeding with suctioning
  - Bleeding quickly became massive
  - Patient becomes asystolic
Case #4

- Diagnosis?
- Tracheoinnominate Fistula
Case #4 – Management

- 7.0 Endotracheal Tube placed through stoma
  - Placed into Right Main Stem Bronchus
  - Hyperinflation of cuff

- PALS

- Rapid transfusion

- Continued tracheal hemorrhage

- No cardiac rhythm noted despite prolonged code
Tracheoinnominate Fistula

- TIF
  - Incidence: 0.3%
  - 10% of Post-Tracheostomy Hemorrhages
  - Peak Incidence POD 7-14
    - Earliest: POD 2
    - 75% by POD 28

http://drhem.com/tag/bleeding/
TIF Pathophysiology

- Erosion from tracheostomy tube into Innominate lumen
  - Pressure Necrosis
    - Cuff Over-Inflation
    - High riding Innominate
    - Low Tracheostomy Tube

TIF Risk Factors

- Low tracheostomy tube placement
- Long tracheostomy duration
- Too large a tracheostomy tube
- Over-Inflation of cuff
- Abnormal thoracic/spinal anatomy
  - Muscular Dystrophy
  - Cerebral Palsy
  - Congenital cardiac defects
TIF Diagnosis

- Sentinel Bleed
  - Flexible Endoscopic Evaluation
  - Consider CTA
  - **Do Not** remove tracheostomy tube unless unable to ventilate
    - Removal of tracheostomy tube increases risk of releasing the tamponade

CT-Angio

TIF Management

- Tamponade
  - Finger compression?
  - Endotracheal Tube (ETT) cuff
- Median Sternotomy for control of hemorrhage

Figure 10-7C

http://www.elsevierimages.com/image/22096.htm
TIF – Surgical Repair

TIF in Duchenne Musculodystrophy Patients


- 1984-2005 9 TIF in DMD pts among 60 who had trach performed (15%)
  - All patients died

- None of the patients were ambulatory
  - All with lordosis or scoliosis

- Role for Prophylactic Ligation of Innominate?
Conclusion

- Pediatric Tracheostomy Care
  - Humidification
  - Suctioning
  - Tracheostomy Tube Change
  - Skin Care
  - Cuff Management
Conclusion

- Pediatric Tracheostomy Care
  - Humidification
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  - Skin Care
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Conclusion

- Increase identification of patients at higher risk for tracheostomy complications
  - Infants
  - Long Duration Tracheostomies
  - Thoracic/Spinal Abnormalities
Conclusion

• Assessment and management of critical airway situations in pediatric patients with tracheostomies
  • A, B, C
  • DOPE
  • Call Code or 911 if:
    • Respiratory distress fails to improve despite suctioning and/or breathing treatments
    • Unable to clear tracheostomy tube
    • Cannot replace tracheostomy tube
    • Significant bleeding
Questions
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