TROUBLE-SHOOTING FOR CAREGIVERS OF CHILDREN WITH TRACHEOSTOMIES OR HOME CARE VENTILATORS IN THE OUTPATIENT SETTING

Beverly Lullo, MD, RRT, NPS, CES
Luanda Rodriguez, RN
Coordinated Care for Children with Medical Complexity (CCCMC) Program
Advocate Children’s Hospital

Objectives of the Coordinated Care for Children with Medical Complexity (CCCMC) Program

- Provide comprehensive, integrated family-based care to patients with complex medical conditions
- Engage all members of the interprofessional care team and community resources to enhance health outcomes for these patients through coordinated care and increased accessibility
- Educate families, providers, allied health professionals, and associates on the care of patients with complex medical conditions and their families
- Reduce Emergency Department (ED) visits and hospitalizations

Respiratory Therapist on Complex Care Team

- Population at increased risk of primary and acquired pulmonary and upper airway disease
- One of the only programs in the U.S. with an integrated RT
- No previous studies evaluating the impact of an RT on a coordinated care team

Trach Basics

Tracheostomy

A tracheostomy is usually placed because of:
- Upper airway obstruction
- Need for better tracheobronchial toilet
- Prolonged positive pressure or ventilatory support

Workshop Objectives

- To understand appropriate applications for different types of trach tubes and adjuncts as well as basic tracheostomy care
- To understand the basics of mechanical ventilation in the home setting and perform ventilator troubleshooting skills
- To demonstrate ability to use troubleshooting algorithms to identify and manage device-related respiratory emergencies

Trach Basics

Indications for a Surgical Tracheotomy in Children

Neurological
- Spina bifida/myelomeningocele
- Congenital neuropathy
- Neurocutaneous syndromes

Obstructive
- Masses
- Tracheomalacia
- Vocal cord paralysis
- Epiglottitis

Pulmonary/Respiratory
- Failure
- iatrogenic dependence

Other (rare)
- Trauma
- Anaphylaxis
- Other (rare)
- Vocal cord dysfunction

Indications for a Surgical Tracheotomy in Children

Neurological
- Spina bifida/myelomeningocele
- Congenital neuropathy
- Neurocutaneous syndromes

Obstructive
- Masses
- Tracheomalacia
- Vocal cord paralysis
- Epiglottitis

Pulmonary/Respiratory
- Failure
- iatrogenic dependence

Other (rare)
- Trauma
- Anaphylaxis
- Other (rare)
- Vocal cord dysfunction
Factors Influencing Tracheostomy Tube Selection

<table>
<thead>
<tr>
<th>I.D./O.D.</th>
<th>Material</th>
<th>Manufacturer</th>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>Uncoated</td>
<td>Shiley, LA, Paediatr Anaesth J 2,3 91-169</td>
<td>PED</td>
<td>Neo/Peds, TRACH tubes</td>
</tr>
<tr>
<td>3.5</td>
<td>Uncoated</td>
<td>Shiley, LA, Paediatr Anaesth J 2,3 91-169</td>
<td>NEO</td>
<td>Neo/Peds, TRACH tubes</td>
</tr>
<tr>
<td>4.0</td>
<td>Uncoated</td>
<td>Shiley, LA, Paediatr Anaesth J 2,3 91-169</td>
<td>PED</td>
<td>Neo/Peds, TRACH tubes</td>
</tr>
<tr>
<td>5.0</td>
<td>Uncoated</td>
<td>Shiley, LA, Paediatr Anaesth J 2,3 91-169</td>
<td>NEO</td>
<td>Neo/Peds, TRACH tubes</td>
</tr>
<tr>
<td>5.5</td>
<td>Uncoated</td>
<td>Shiley, LA, Paediatr Anaesth J 2,3 91-169</td>
<td>NEO</td>
<td>Neo/Peds, TRACH tubes</td>
</tr>
</tbody>
</table>

Trach Types

- **Tracheostomy**: a surgical opening to the trachea
- **Suctioning**: artificial airway-trach
- **Care of the Pediatric Patient with a Tracheostomy**

BIVONA Trach Tubes
- Manufactured with biocompatible silicone with wire reinforcement to resist kinking
- All have 15mm hub
- Neonatal, Pediatric, Adult Single-Cannula Trach Tubes
- Sterile/Modified, Custom Tubes
- Cuffed and Cushion
- Manufacturer supports reprocessing

Suctioning Artificial Airway-Trach
- Techniques: Sterile/Modified, Sterile/Clean Technique
- Size: 10-12 is greater than 7/3.5
- Measured Suction Depths: shallow/deep
- Suction Pressure: 60-80 mm Hg adult
- 80-100 mm Hg child
- 100-120 mm Hg older child to adult

Trach Tube Adjuncts & Precautions

- Care of the Pediatric Patient with a Tracheostomy
  - In-depth information included in handbook

Sizing Comparison Chart
Neonatal and Pediatric Tracheostomy Tubes

8/22/2017
**Suctioning**

- **CONTENTS OF EMERGENCY TRAVEL BAG**
  - Ambu bag
  - Two end tubes (one same as one tube)
  - Suction bottle
  - 10 oz. or 2 oz. Don Lee suction trap
  - O2 nose frida
  - Suction catheter
  - Water soluble lubricant
  - blunt end scissors
  - Ventral trach tape
  - Saline

**Troubleshooting**

- Take a deep breath
- Be prepared for the unexpected
- Know your equipment
- Ask parents if they brought their trach bag.

**Meatrical Ventilation**

**Complications**

- Tracheitis: dry, not enough humidity
- Erosion of the tracheal (intratracheal tracheal tube)
- Tracheal stenosis: results from scar tissue at the site of the trach tube
- Tracheomalacia: not enough pressure
- Tracheomalacia: flat, abnormal connections
- Tracheomalacia: trachea not inflated
- Suction: results from pressure of the trach tube
- Granuloma: growth of abnormal tissue which is caused by irritation of the trach tube in airway
- Pressure on tracheal infants/children with short necks may develop infections or pressure sores at trach site
- False tract: trach is dislodged outside of trachea

**Travel Equipment List**

- Bag/Back pack
- Portable suction
- Reliable glucose monitor
- Portable oxygen
- Emergency medication
- Ambu bag
- Ventilator
- Nebulizer
- Oxygen concentrator
- Percussion tractor
- Suction catheters
- Bag/mask
- Water

**Troubleshooting**

- **Bleeding**
  - Trach Occlusion
  - Trach Dislodgement
  - Unable to Reconcile
  - Tubing Recalculations: is the vent or oxygen ok?

**Goals**

- Achieve and maintain adequate gas exchange
- Increase lung volume
- Maintain adequate functional residual capacity (FRC)
- Minimize the risk of lung injury
- Reduce patient workload of breathing
- Optimize patient comfort

**Ideal Breath Delivered**

- **Delivers a breath that**
  - Synchronizes with the patient’s spontaneous ventilatory efforts
  - Maintains adequate and consistent tidal volume and minute volume at low airway pressures
  - Responds to rapid changes of pulmonary mechanics or patient’s demand
  - Provides lowest possible WOB

- [https://www.youtube.com/watch?v=ovvH1FcgHe](https://www.youtube.com/watch?v=ovvH1FcgHe)
Methods of Air Delivery by Ventilator

By Volume
- Guaranteed tidal volume delivery
- Volume not affected by lung compliance
- Variable pressure

Disadvantages:
- Barotrauma due to high peak pressures

By Pressure
- Constant Pressure
- Expiratory Decelerating, variable inspiratory flow rate (similar to spontaneous breaths)

Disadvantages:
- Pressure not delivered when compliance decreases

Pressure Support [Inspiration]
- A method of aiding spontaneous breaths
- The patient controls part of the breath versus the pressure level
- The patient controls when the inspiration begins after the pressure level is reached

Disadvantages:
- Volume not delivered when compliance decreases
- Barotrauma due to high peak pressures

CPAP-EPAP [Expiration]
- Continuous positive airway pressure
- Pressure can be maintained at the CPAP level
- Allows breaths to occur continuously

Disadvantages:
- Pressure not delivered when compliance decreases

Non-Invasive Ventilation
- May provide comfort and decreased WOB for parents who have decided not to trach

Largest barriers:
- Appliance interface for small children
- Lack of reimbursement for children less than 2 years old

Home Ventilators

Average Volume Assured Pressure Support
( AVAPS)

- Average volume assured pressure support (AVAPS) is a feature available in S, T/I, PC and T modes only
- AVAPS assists patients in maintaining a target VT by automatically controlling the pressure support
- If the ramp function is activated, it will take precedence over the AVAPS feature

Synchronized Intermittent Mandatory Ventilation (SIMV)

- Set breath rate is mandatory
- Ventilator synchronizes with the patient's effort
- Patient is able to take spontaneous breaths between mandatory breaths
- Add Pressure Support to decrease work of breathing on spontaneous breaths

Trilogy Ventilator Modes

Pressures and Additional Interfaces

Trilogy User Interface

Waveform-screen

Main-screen

Detailed-screen

Quality feedback what you are looking for: Boosted control over range from zones

Lap Top Ventilator (LTV)

930, 1150, 1200

Sprintpack

8/22/2017
LTV Side Panel Pressure Line Connections

Troubleshooting

<table>
<thead>
<tr>
<th>Know signs and symptoms of problems</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased tidal volume</td>
<td>Decreased tidal volume</td>
</tr>
<tr>
<td>Patient is breathy</td>
<td>Patient is breathy</td>
</tr>
<tr>
<td>Patient has rales</td>
<td>Patient has rales</td>
</tr>
<tr>
<td>Increased # of wheezes</td>
<td>Increased # of wheezes</td>
</tr>
<tr>
<td>Decreased or No chest rise</td>
<td>Decreased or No chest rise</td>
</tr>
<tr>
<td>Change in level of consciousness</td>
<td>Change in level of consciousness</td>
</tr>
</tbody>
</table>

Questions?

- Beverly.Lullo@advocatehealth.com
- Luanda.Rodriguez@advocatehealth.com

Special Thank You

- Renwick Taylor, MD, Elise Gentile, MS, APN, CPNP, Patricia M Notario, MD, Research Team.
- Dr. Taylor won the Golden Stethoscope award for his presentation on the role of the RT in caring for the Medically Complex child.
- Vyaire for supplying an LTV ventilator for this workshop.
- Phillips Respironics for supplying a Trilogy ventilator for this workshop.

Internet Resources

- Aaron's Tracheostomy Page: [www.tracheostomy.com](http://www.tracheostomy.com)
  Resource for parents and professionals. Site was developed by Cynthia Bissell, RN, who has a son who required a tracheostomy for 4 years.
- LTV Care Giver Videos: [https://www.youtube.com/watch?v=6K6tqc1wgpg&t=11s](https://www.youtube.com/watch?v=6K6tqc1wgpg&t=11s)
  Learning modules for healthcare professionals. Information on PMV usage infant-adult.
- Trilogy Vent. Set-up: [https://www.youtube.com/watch?v=AGPS59KQ1-g](https://www.youtube.com/watch?v=AGPS59KQ1-g)