Respiratory Therapy Overview

Taresa Crisler RRT-NPS, Clinical Preceptor/Educator
Seattle Children’s Hospital
Disclosure Statement

• I do not have any conflict of interest, nor will I be discussing any off-label product use.

• This class has no commercial support or sponsorship, nor is it co-sponsored.
Objectives

- Discuss clinical signs and symptoms of respiratory distress and failure in pediatrics
- Review respiratory interventions: $O_2$ delivery, Sx, and resuscitation bags
- Review bronchodilator therapy and other aerosols: how to open the lungs
- Discuss Airway Clearance modalities: how to keep lungs clear
Children have proportionally lower $V_D/V_T$ (greater deadspace), higher resistance, obligate nasal breathers.
Why Do You Need to Know This?

• #1 reason children go into cardiac arrest is respiratory failure
• 5-12% of children who have a cardiac arrest outside a hospital live to go home
• 27% of children who have a cardiac arrest in the in-hospital setting live to go home
• We are in the business of…

ARREST PREVENTION!!!
General Respiratory Assessment: Where do you start?

• Start from the doorway.
  • What do you see?
    • Chest movement
    • Facial expressions (Parents and/or child)
    • Positioning
    • Calmly watching TV
  • What do you hear?
    • Stridor
    • Grunting
    • Secretions
    • Crying
    • Singing
Signs and Symptoms of Distress

- Suprasternal
- Supraclavicular
- Intercostal
- Substernal
- Subcostal

Infant with respiratory distress (including orthopnea and tachypnea)
- Perspiration and tense, anxious facies
- Flared nostrils
- Sternal retraction
- Intercostal retractions
What about rate?

- What’s “normal” for ...

  - Infant 25-40
  - Toddler 20-35
  - Preschooler 20-30
  - School age 12-18
  - Teenagers 12-16
What can we do to prevent this
INSTANT OXYGEN
Full Gallon
only $1.98
Completely Safe
Medically Pure
Oxygen Therapy: Low Flow Devices

- Standard Infant Oxygen Cannula
- Standard Peds/Adult Oxygen Cannula (1-4 L/min or 24-44%)
- Standard Infant Oxygen mask (5-10 L/min or 35-55%)
Oxygen Therapy: High Flow Devices

- Aerosol Mask (ineffective for “hydrating airways or removing secretions)
- Venturi Mask (24-55%)
- Non-rebreather Mask (>90%)
Heated/Humidified High Flow Nasal Cannula (HFNC)

Infant: Flow > 2 L/min

Large Pediatric: Flow > 6 L/min
High Flow Nasal Cannula

Flow Rate > 2 L/min; monophasic flow

- Provides heated humidified gas to eliminate drying of nasal mucosae and secretions
- Generates CPAP in the lung
  - Difficult to measure, variable with leak
  - “Flushing” effect of anatomic dead space; similar to TTO
- May be better tolerated than N-CPAP
  - Easier interface
  - Less nasal injury
So what is next?
Noninvasive Ventilation
Suctioning
What?!!?
Suctioning Practices

Nasopharyngeal (NP) Sx

Olive Tip Sx

Bulb Sx

Vacuum Sx Pressures: 80-120 cm H₂O
Suctioning Practices

- Simplify to two suction categories: nasal and NP
- No longer use the term “deep suctioning” or “deep NP”
- Nursing/RT is to insert the catheter into the child’s nose at the approximate depth of nose to ear measurement and advance until cough
- Using this technique, the tip of the suction catheter should remain in the posterior pharynx
- The goal is to mobilize secretions and provide aid with airway clearance
Bag Valve Mask
Ventilation
Bag Ventilation

Ambu Bags

Popoff Valve
Aerosolized Drug Delivery

- Open the airways
- Facilitate secretion removal
Table 1. Age Guidelines for Use of Aerosol Delivery Device Types\textsuperscript{3,8,9,14,39}

<table>
<thead>
<tr>
<th>Aerosol Device and Interface</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-volume nebulizer with mask or hood</td>
<td>Infants</td>
</tr>
<tr>
<td>Small-volume nebulizer with mask</td>
<td>( \leq 3 \text{ y} )</td>
</tr>
<tr>
<td>Small-volume nebulizer with mouthpiece</td>
<td>( \geq 3 \text{ y} )</td>
</tr>
<tr>
<td>pMDI with valved holding chamber/spacer and mask</td>
<td>(&lt; 4 \text{ y} )</td>
</tr>
<tr>
<td>pMDI with valved holding chamber/spacer</td>
<td>( \geq 4 \text{ y} )</td>
</tr>
<tr>
<td>DPI</td>
<td>( \geq 4 \text{ y} )</td>
</tr>
<tr>
<td>MDI</td>
<td>( \geq 5 \text{ y} )</td>
</tr>
<tr>
<td>Breath-actuated MDI (eg. Autohaler)</td>
<td>( \geq 5 \text{ y} )</td>
</tr>
<tr>
<td>Breath-actuated nebulizer</td>
<td>( \geq 5 \text{ y} )</td>
</tr>
</tbody>
</table>

pMDI = pressurized metered-dose inhaler  
DPI = dry powder inhaler
How do we deliver these to infants and toddlers?
Keep things interesting
Facemask and Aerosol Delivery In Vivo

Drug deposition <0.35% when an infant is crying or screaming
AeroChamber MAX™ VHC
How to Administer MDIs with Spacer

1. If possible, sit pt upright.
2. Use MDI-VHC with mouthpiece or face mask
3. With facemask or mouthpiece in place, actuate MDI.
4. Allow the pt to breath 5 to 6 spontaneous breaths between actuations.
5. Slow, deep breathing, with inspiratory hold if possible. This greatly improves drug deposition.
6. Shake MDI canister between actuations
Vibrate Your Body And Make it Well

You have no right to be sick. Pain, suffering and disease are unnatural, they are wrong. It is your duty to be well. Don’t try to stand pain—CURE IT! No matter what ails you—even if others have told you that your case was untreatable—DON’T GIVE UP HOPE. The great natural force has not given up on you today than all the drugs and doctors in the world put together.

THE WHITE CROSS ELECTRIC VIBRATOR

multiplies both of the organs naturalcreative spirits. It gives you your desire of health and uprightness, just as you wish. It releases pain instantly, and its every movement

The White Cross Electric Vibrator moves the organs of disease. It speeds healing, stirs dead tissues and removes through the body. It will not give up until it has given. It speeds your recovery and brings back every thing in order. It makes you lighter and stronger and every thing happy. Don’t neglect the FIRST treatment. If you fail to get well now, you will never be well. If you do not make the first treatment, you can never recover. The White Cross Electric Vibrator fills your body so full of energy that pain and disease cannot last a second.

FREE BOOK
“Health and Beauty”

SEND TODAY for the magnificent free book, “Health and Beauty.” This valuable work tells you all about the health in body and clean in appearance. How you will keep well, no matter what your troubles. This book was not written for surgeons and physicians, but for every American who wants to be well. It tells you about a great new discovery which is setting the world on fire. It tells you about the White Cross Electric Vibrator. You can see it. White Cross Electric Vibrator is a genuine free trial. Your name and address brings this valuable information book by return mail. Sign the coupon and mail it to us.

Vibrating Chair Free

With the White Cross Electric Vibrator, you can transform any ordinary household chair into a vibrating chair, according to many respect. None of it is big household and surroundings. You can use your present furniture, including the favorite rocking chair. This is a real benefit of the new electric vibratory items. This makes you the owner of the White Cross Electric Vibrator absolutely free.

Send Coupon Today For Free Book

DON’T DELAY A MINUTE. Whether you are in or out of work, you should send for this book at once. It will show you the value of a White Cross Electric Vibrator. When you send for it, you will be in no hurry to send for it. Learn something that vibrating will do for you, for all your loved ones. Learn all about the wonderful electric vibratory items. Learn them at home, at your leisure, without expense.

SEND NO MONEY, just your name and address to the coupon. But hurry today.

LINDSTROM, SMITH CO.,
223 LaSalle Street
CHICAGO

Airway Clearance
Airway Clearance Techniques (ACTs) are used in a variety of settings for a variety of clinical ailments:

1) evidence of retained pulmonary secretions
2) weak or ineffective cough
3) focal lung opacity on chest x-ray consistent with mucous plugging and/or atelectasis and
4) intrapulmonary shunt requiring oxygen
Airway Clearance Techniques

- At our institution, these therapies include: acapella and aerobika therapy, mechanical insufflation-exsufflation, positive expiratory pressure (PEP), huffing techniques and incentive spirometry (IS).
- Chest physical therapy (CPT) with postural drainage is the most commonly used technique for airway clearance.
More airway clearance devices

Acapella

Aerobika

Mechanical Insufflation/exsufflation
Aka “Cough Assist”
Even more ways to facilitate airway clearance

- Incentive Spirometry
- Ambulation
- Breathing games: BUBBLES
Interesting facts from research

• ACTs have only been shown to be effective in children with CF, Bronchiectasis and neuromuscular weakness

• Definitive data do not exist for common forms of pediatric respiratory failure
  • Pneumonia (may cause patients condition to worsen)
  • Bronchiolitis, asthma, pleural effusion
  • Prevention of atelectasis
The Use of Chest Physiotherapy

- Chest physiotherapy (CPT) had no effect on length of hospital stay, fever, or radiographic findings. Some suggestion that CPT is counterproductive, with longer fever lengths. A supported sitting position may help to expand the lungs and improve respiratory symptoms in a child with respiratory distress.

- It is recommended that therapies directed toward airway clearance, such as postural drainage and CPT not be used for the patients with uncomplicated pneumonia.

- Early mobilization (movement out of bed with change from horizontal to upright positioning for at least 20 minutes in the first 24 hours of stay and subsequent increasing activity each additional day) alone may be more effective than usual care at reducing the mean length of stay. Bottle blowing plus encouragement to sit up 10 times a day and early mobilization may decrease length of stays.

[LOE: ★★☆☆☆ Low quality] (Gilchrist, 2008)
<table>
<thead>
<tr>
<th>Proven</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystic Fibrosis</td>
<td>Lower re-intubation rate in neonates</td>
</tr>
<tr>
<td>No one specific airway-clearance</td>
<td>chest physical therapy</td>
</tr>
<tr>
<td>therapy superior</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probable</th>
<th>Minimal to No Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuromuscular disease:</td>
<td>Asthma</td>
</tr>
<tr>
<td>assisted ventilation,</td>
<td>Bronchiolitis</td>
</tr>
<tr>
<td>insufflation-exsufflation,</td>
<td>Neonatal respiratory distress syndrome</td>
</tr>
<tr>
<td>IPV</td>
<td>Acute respiratory failure</td>
</tr>
<tr>
<td>Atelectasis during mechanical ventilation:</td>
<td>Postoperative atelectasis</td>
</tr>
<tr>
<td>IPV</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3. Benefit from airway-clearance therapies. IPV = intrapulmonary percussive ventilation.
Risks Associated with ACT

- Gastroesophageal reflux *(Button BM, Pediatr Res 1994)*
- Decreased oxygenation and increased oxygenation requirements *(Hough JL, Cochrane, 2008)*
- Increased intracranial pressure and intracranial bleeding *(Harding JE, J Pediatr, 1998)*
- Longer duration of fever *(Britton S, BMJ, 1985)*
- Increased vomiting and respiratory instability *(Roque et al., Cochrane, 2012)*
- Increased SOB, arrhythmia, bronchospasm, thoracic hematoma *(Andrews J, Resp Care, 2013)*
That's it!!

Thank you so much for having me!

Questions?