Managing Pediatric Patients on Non-Invasive Ventilation
FDA guidelines

- **Newborn (neonate)**
  - from birth to 1 month of age

- **Infant**
  - greater than 1 month to 2 years of age

- **Child**
  - greater than 2 to 12 years of age

- **Adolescent**
  - greater than 12 to 21 years of age

http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089740.htm
Ventilation
- Pediatrics
- NIV

Disorders
- Pediatric disorders

Masks
- Masks
What is NIV?

The application of positive pressure ventilation *without* airway intubation for the purpose of augmenting alveolar ventilation.\(^1\)

Goals of NIV

• Avoid intubation
• Improve mortality
• Decrease VAP
• Maximize patient comfort

Goals of NIV

- Alleviate respiratory distress\(^1\)
- Decrease WOB\(^1\)
- Decrease LOS\(^2\)

Initial NIV settings

- IPAP: 8-10 cmH₂O
- EPAP: 4-6 cmH₂O
- FIO2: per hospital protocol

Contraindications

- Excessive secretions¹
- Uncooperative¹
- Unconscious¹
- Unable to protect the airway¹
- Hemodynamically unstable¹

Pediatric Disorders

- RSV
- Pneumonia
- Croup
- Asthma
- Epiglottitis
- Cystic fibrosis
RSV

- Respiratory tract infection
- 1 out of every 10 children under the age of 21
- May require ventilation and oxygenation

An x-ray of a child with RSV showing the typical bilateral perihilar fullness


*Obtained from Wikipedia-used with permissions
Croup

- Viral disorder\(^1\)
- Subglottic swelling and obstruction\(^1\)
- Barking cough and stridor\(^1\)
- May require supplemental oxygen\(^1\)

AP x-ray of the neck in a child with croup demonstrating the steeple sign; narrowing of the trachea*  

*Obtained from Wikipedia-used with permissions
Epiglottitis

- Life-threatening\(^1\)
- Upper airway obstruction\(^1\)
- May require intubation\(^1\)

Visible epiglottis at the back of the throat on a two year old*  

\(^*\)Obtained from Wikipedia-used with permissions
Cystic fibrosis

- Genetic disorder
- Produces copious secretions
- May require supplemental oxygen

\[1\text{Wilkins, et al. Egan's Fundamentals of Respiratory Care, 9th Ed., 2009.}\]
Asthma

- Airway obstruction\(^1\)
- Airway inflammation\(^1\)
- Management is prevention\(^1\)

Asthma

Most common medical emergency in pediatric patients

Asthma

- BiPAP therapy
- Intubation

**Conclusion**

Patients treated safely with BiPAP and it was well tolerated

No adverse effects noted

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**Clinical status after initiation of BiPAP**

- 77%-decreased RR
- 88% - improved $O_2$ saturation

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**83 pediatric patients with status asthmaticus**

- 73 (88%) BiPAP
- 57 of 73-PICU

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**Conclusion**

BiPAP safely and effectively improved respiratory status  
BiPAP may decrease the need for intubation

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1. Joshi, G., *Five-Year Experience with the Use of BiPAP in Pediatric Intensive Care Unit Population; Journal of Intensive Care Medicine*  
   2007, Vol. 22;No.1:38-43
Prospective, randomized study in US

20 children – lower airway obstruction

2 hrs NIV followed by 2 hrs standard therapy OR

2 hrs standard therapy followed by 2 hrs of NIV

Results

- Decreased WOB
- Decreased accessory muscle use
- Decreased RR
- Decreased dyspnea

¹Thill, P. et al., Noninvasive positive-pressure ventilation in children with lower airway obstruction; Pediatr Crit Care Med 2004; Vol5, No.4:337-342
Conclusion:

NIV success = 57%

NIV can be successfully applied to infants in ARF

42 hypoxemic or hypercarbic RF

RF patients at risk for intubation

Median age = 2.45 yrs

21 patients received NIV

Pneumonia

- Major cause of morbidity and mortality
- Community-acquired
- Hospital-acquired

A very prominent pneumonia of the middle lobe of the right lung*


*Obtained from Wikipedia-used with permissions
Mask considerations

- Well-fitting
- Comfortable
- Minimal leaks

Sizing is tricky business
Sizing analysis

Eye width

Temple to temple

Chin to forehead

Chin to Forehead Height (averaged)
PerforMax small

- 7 years or old (> 20 kg)
- SE or EE Leak 2 elbows
- Rapid application
PerforMax x small

- 1 year or older (> 7 kg)
- SE or EE Leak 2 elbows
- Bonnet headgear
PerforMax xx small

- 1 year or older (> 7 kg)
- SE or EE Leak 2 elbows
- Bonnet headgear
PN831

- 1 year or older (> 7 kg)
- Nasal gel mask
- Leak 4 setting on V60
Ventilator compatibility

Philips ventilators intended for pediatric masks:

<table>
<thead>
<tr>
<th>Ventilator</th>
<th>Location</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trilogy 202</td>
<td>Institutional</td>
<td>&gt; 7kg</td>
</tr>
<tr>
<td>Trilogy 100</td>
<td>Institutional</td>
<td>&gt; 7kg</td>
</tr>
<tr>
<td>V60</td>
<td>Institutional</td>
<td>&gt; 20kg</td>
</tr>
</tbody>
</table>
Take aways

- Kids are **NOT** little adults
- NIV-first choice therapy
- Small faces need small masks