Respiratory Care-Beyond Oxygen Therapy

KIDS ROCK CONFERENCE-2015

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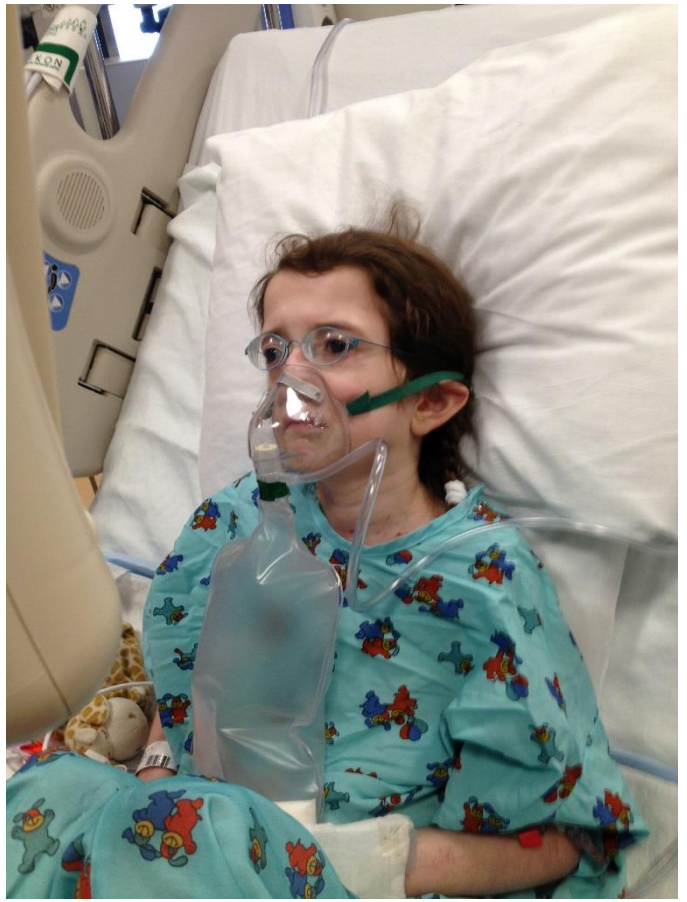
Objectives

- Define high flow oxygen therapy
- Review the mechanism of action of how high flow therapy works
- Describe options available in the pediatric and neonatal population
- Describe options for noninvasive ventilator support.

Oxygen Therapy Device in ER

- Accuracy of delivered oxygen
- Humidification
- Limited options
- Compliance



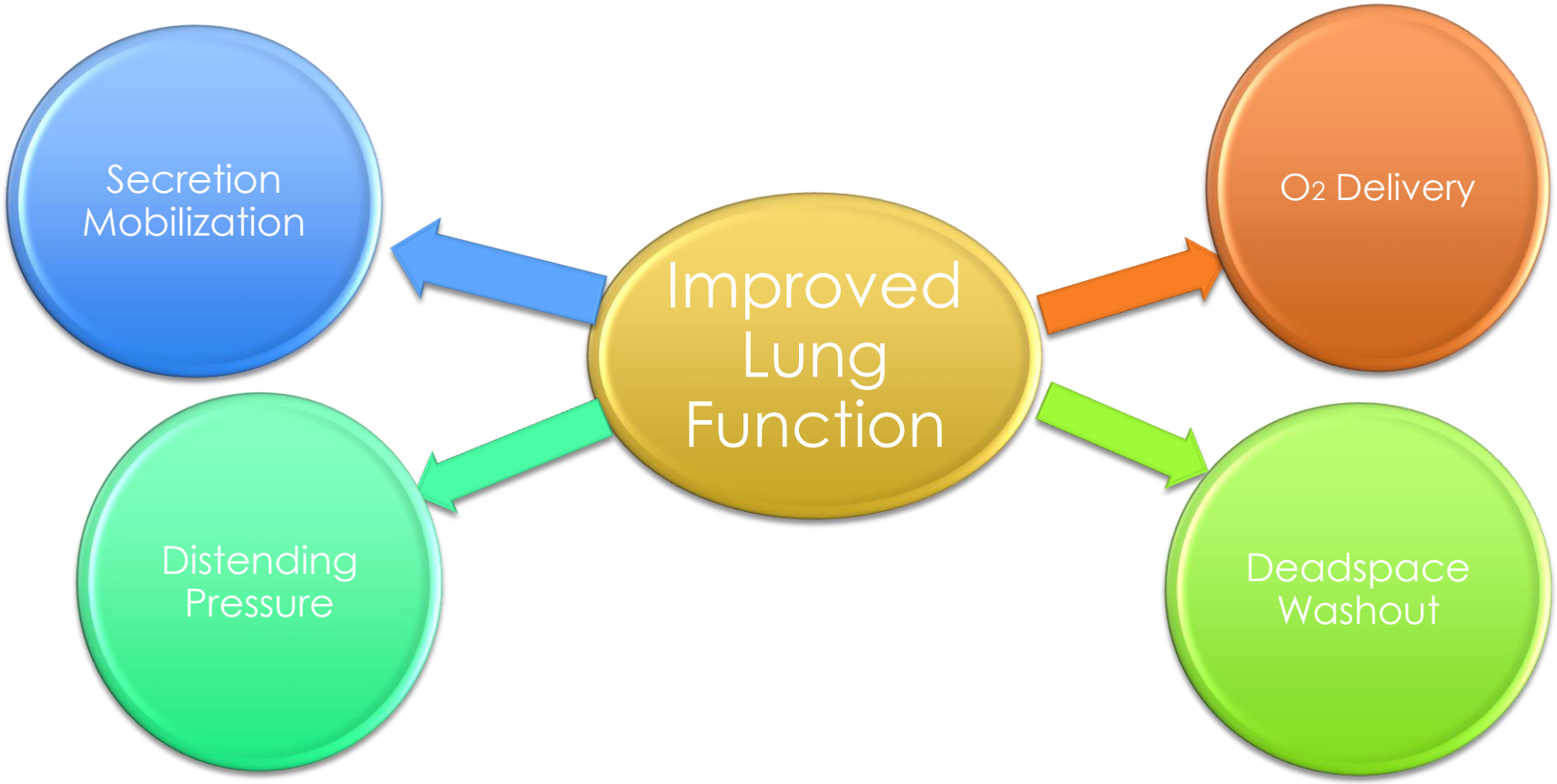
High flow options

Nasal Cannula for high flow?

- Typical low flow cannula use is limited to 5-6 L/min
- More often limited to very low flow (<200 ml)

- Delivers high flow to exceed the patient's demand
- Increased patient comfort with optimized humidity
- Improved compliance

Benefits of High Flow cannula



How does High Flow Nasal Cannula work

- Exceeds inspiratory flow demands
- Decreases nasal resistance
- Warmed, humidified gas improves conductance, compliance and lung elasticity
- Restores mucociliary tree
- Flow can generate pressure for lung recruitment
- Deadspace washout-efficient minute ventilation

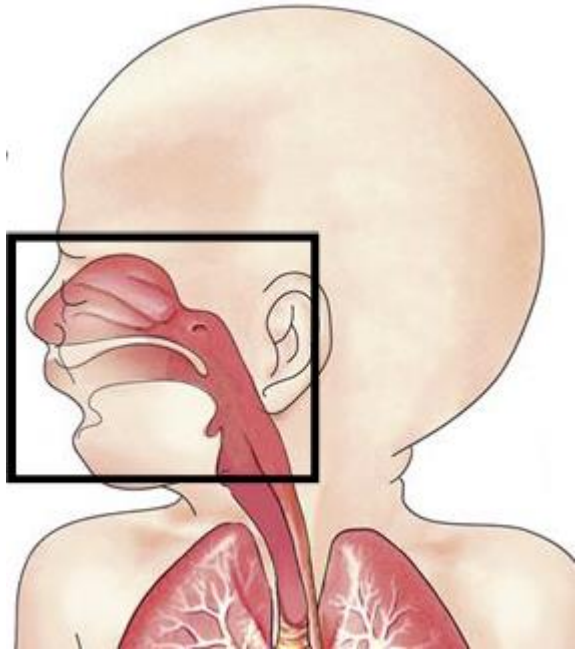
Effective Oxygen Delivery

High flow aims to exceed the demands of the patient:

- Minimized room air dilution
- Precisely controlled oxygen delivery
- Humidification

Washout of Anatomical Deadspace

- Continuous washout of anatomical deadspace (upper airway) with delivery of a high flow gas
- Advantage:
  - Reduces rebreathing of expired CO_2
  - Provides a reservoir of fresh gas with each breath
- Results: More effective gas exchange



Importance of Humidification

" ADEQUATE HUMIDIFICATION IS REQUIRED TO MAINTAIN CILIARY ACTIVITY, PREVENT SQUAMOUS EPITHELIAL CHANGES, PREVENT DEHYDRATION AND THICKENING OF SECRETIONS, MINIMIZE ATELECTASIS AND TRACHEITIS, AND DECREASE HEAT LOSS."[1]

1. Waugh J et al Respiratory Care 2001

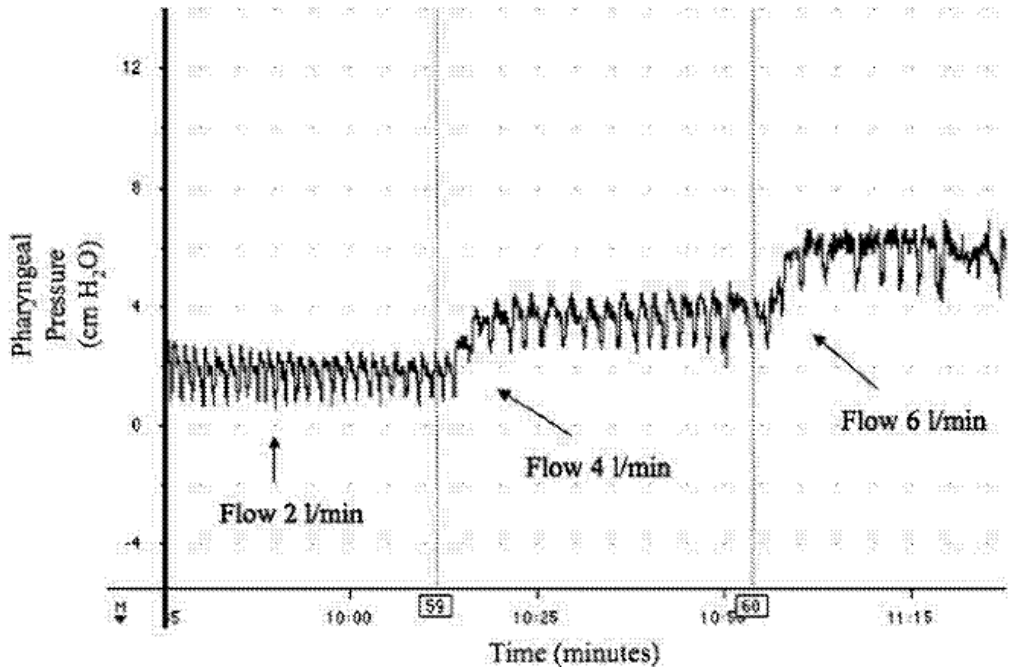
	MEDICAL GASES	TYPICAL ROOM AIR	LUNGS
• TEMPERATURE	15°C	20°C	37°C
• RELATIVE HUMIDITY	2%	50%	100%
• ABSOLUTE HUMIDITY	0.3 mg/L	9 mg/L	44 mg/L

- Improved secretion quality
- Maintenance of the mucosal function
- Secretions remain mobile for transport out of the airway
- Prevents insensible heat loss
- Prevents changes in nasal airway resistance

Positive Airway Pressure

Variables that affect pressure delivered:

- Flow rate
- Upper airway anatomy
- Size of cannula relative to the nares
- Mouth position (closed or open)



High Flow Nasal Cannula

- Neonatal/Pediatric sizes(Optiflow Junior)
  - 4 sizes –colour coded
  - Max flow of 25 L
  - Up to 25kg
- Adult (Optiflow)
  - 3 sizes available
  - Max flow 60 L/min
  - Small may fit pediatric patient 4-5 years old

F&P OPTIFLOW JUNIOR

OPTIFLOW JUNIOR NASAL CANNULA	ITEM CODE	APPROX WEIGHT (KG) 2 4 6 8 10 12 14 16 18 20 22	SPARE WIGGLEPADS
Premature Size	OPT312	Max. flow 8 L/min	OPT010
Neonatal Size	OPT314	Max. flow 8 L/min	OPT012
Infant Size	OPT316	Max. flow 20 L/min	
Pediatric Size	OPT318	Max. flow 25 L/min	

Getting Started

- Determined by patient size and minute ventilation
- Maximum flow is determined by cannula size (1/2 diameter of nares)

- Initiation (patient specific)
  1. Start flow low, with same FiO_2 as patient is currently receiving
  2. Keep in mind patient's minute ventilation
     - If oxygenation is primary issue – patient will require higher flow rates to meet/exceed their minute ventilation demands to deliver consistent FiO_2 AND
     - Higher flow rates will deliver moderate amounts of pressure to help with lung recruitment (smaller patients)
  3. Adjust flow upwards until WOB is decreased, monitor patient
  4. Titrate FiO_2 as tolerated

Patient selection

- High FiO_2 requirements
- Moderate respiratory distress
- Patients with increased deadspace ventilation
- Post extubation
- Patients requiring high humidity
- Patients that require a “break” from their CPAP/BiPAP
- Patients with tracheostomies

Who shouldn't use high flow…

- Not a substitute for ventilation (invasive or non-invasive)
- Patients that require the restoration of FRC (requires positive pressure)
- Patients that have decreased LOC or respiratory depression
- Patients who require CPAP for the reduction of afterload

Non-invasive Ventilation-Challenges

- Limited options for pediatrics-most devices designed for >35 kg
  - Lacked sensitivity for patient triggered breaths
  - Uncomfortable for a smaller patient in distress
- Limited interfaces for the 5-20 kg patient
- Compliance
- Early intervention

Where are we now?

Devices now sensitive to weights less than 5-10 kg

- Improved flow sensitivity-better comfort for smaller patients
- Increased pressure capability (up to 30 cmH20)
- Battery for transporting patient without interrupting support
- Download capability

Interfaces-Nasal

Full/Total face masks

Patient Selection

- Disease pathology
  - Neuromuscular disease
  - Pulmonary edema
- Disease progression
  - Earlier intervention more successful
- Compliance
- Failure of other options (like high flow therapy)
- Must have intact respiratory drive
- Caution with reflux/impaired airway protection

CPAP vs BiPAP

CPAP

- Used for obstructive sleep apnea
- Overcomes resistance caused by a collapsed upper airway

BiPAP

- Provides 2 pressure levels
  - IPAP-Inspired pressure
  - EPAP-Expired pressure
- Improves minute ventilation by increasing spontaneous Vt
- AVAPS-guaranteed volume(>200ml)


Air goes in and out.
Blood goes round' and round'.
Any deviation to the above is
Complicated.