CPAP
Pre-Hospital Treatment Using The Respironics Whisperflow CPAP Device
CPAP - What Is It?

- Continuous
- Positive
- Airway
- Pressure
Anatomy Review

Younger lungs

Alveoli
Anatomy Review

- Alveoli
Anatomy Review

• Chest Wall
Physiology Review

• Normal Respiration
Physiology Review

- **Ventilation** - The mechanical exchange of air between the lungs and the atmosphere
  - **Pulmonary ventilation** refers to the total exchange of gas.
  - **Alveolar ventilation** refers only to the effective ventilation within the alveoli.
Physiology Review

• **Respiration** - the exchange of oxygen and carbon dioxide between the atmosphere and the body cells
  - Occurs at the alveolar level
Physiology Review

- **Diffusion** - the movement of gas from an area of higher concentration to an area of lower concentration
  - This is how respiration occurs
  - Must have:
    - Functional alveoli and capillary walls
    - An interstitial space between the alveoli and capillary wall that is not enlarged or filled with fluid
Physiology Review

- **Pulmonary Perfusion** - the process of circulating blood through the pulmonary capillary bed
  - Must have:
    - A properly functioning heart (pump)
    - Proper vascular “size” (tank)
    - Adequate blood volume / hemoglobin (fluid)
Using CPAP For Respiratory Emergencies
What Can We Use CPAP For?
• Asthma
• COPD
• CHF
• Pneumonia
Asthma

• A chronic inflammation disorder in the airways

• Acute episodes “triggered” by something
  - Causes release of histamine, leukotrienes
    • Bronchial smooth muscle constriction
    • Bronchial plugging from mucus secretion
    • Inflammation changes
Asthma (cont)

• Leads to increased resistance to airflow!
• Leading to hypoxemia and CO2 retention
• Leading to hyperventilation
• Leading to...respiratory fatigue
Asthma Assessment/Presentation

- Tripod Position
- Wheezing
  - A silent chest is an ominous sound!
  - Flow rates are too low to generate breath sounds
- Inability to speak
- Pulse > 130
- Respirations > 30
Asthma - Differential Diagnosis

- Consider other causes
  “All that wheezes is not asthma”
  - Pneumonia
  - COPD
  - Foreign body aspiration
  - Heart failure
  - Pneumothorax
  - Pulmonary embolism
  - Toxic inhalation
COPD

- Chronic Obstructive Pulmonary Disease
  - Chronic Bronchitis
  - Emphysema
Bronchitis

• Inflammation of the bronchioles with large amounts of sputum present

• Mucus obstructions
  – Leads to gas trapping
  – Leads to hyper-inflation
  – Leads to permanent damage

• SOB because of mucus in alveoli
Bronchitis Assessment/ Presentation

- History of respiratory infection
- Productive cough
  - Large quantity of sputum
- SOB
- Cyanosis
Bronchitis Assessment/Presentation

Air comes in, but can’t get out!
Bronchitis - “Blue Bloater”

• A productive cough 3 months of the year for 2 consecutive years
Emphysema

- Chronic disease
- Result of destruction of the alveolar walls
  - Cigarette smoking
  - Exposure to “unfriendly” environment
Emphysema - Assessment/ Presentation

- Skinny!
- SOB all the time
- SOB worsens with any activity
- Barrel chest
- Long expiratory phase - Pursed lip
- Pink in color (polycythemia)
Emphysema - “Pink Puffer”
Pneumonia

- Infection of the lung (in the alveoli)
- Bacteria or virus invade the lung and multiply
- Body sends WBC to fight infection
- Causes “consolidation” in alveoli
Pneumonia - Assessment/Presentation

- Patient looks “ill”
- History of fever
- Productive cough with yellow/tan/green
- Localized wheezing / rhonchi in affected lobe, breath sounds may be diminished
Pneumonia

- Normal Bloodstream and Alveoli
- Pneumonia with Fluid Filling Air Spaces
Congestive Heart Failure (CHF)

- Left ventricle unable to clear
- Leads to increased pressure in left atria
- Leads to increased pulmonary pressures
- Fluid collects in lungs
CHF - Assessment/ Presentation

- Respiratory Distress
- Orthopnea
  - Must sit or stand to breathe comfortably
- Spasmodic coughing (pink frothy sputum)
- Paroxysmal Nocturnal Dyspnea
- Severe Apprehension, Confusion, “Smothering Feeling”
- Cyanosis
- Diaphoretic
- Crackles
- Wheezing?
- JVD
CHF - Assessment/ Presentation

• Vitals:
  - Sympathetic NS discharge
    • Increased blood pressure early
    • Decreased BP later as patient tires
  - Tachycardia
  - Increased respiratory rate early (40’s)
  - Decreased respiratory rate as patient tires
So How Do We Treat Them? ...

• The same way we always have. Now we just have a new tool.
Continuous Positive Airway Pressure

• Respironics Whisperflow
Circuit Components

- These components come prepackaged together.
- Located inside the flap of the CARS Advanced Airway Kit.
CPAP Valves

- Valves control pressure setting
- Comes preassembled with a 7.5 cmH2O valve
- Valves use precision springs
CPAP Generator

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How It Works - Mechanically

- **Venturi Effect** - Can generate large flows (140 L/min) with relatively little oxygen usage
  - Mixes large quantities of ambient air with a little supplemental oxygen
- **FiO2 ~30%**
How It Works - Physiologically

• Creates a positive end expiratory pressure (PEEP) of our choosing.
How It Works - Physiologically

- It changes the partial pressure of oxygen in the blood.
- Deoxygenated blood has a lower partial pressure of oxygen than alveolar air so oxygen transfers from the air into the blood.
How It Works - Physiologically

• **7.5 cm H2O CPAP** increases the partial pressure of the alveolar air by approximately **1%**.

• **This increase in partial pressure** ‘forces’ more oxygen into the blood.

• **Even this comparatively small change** is enough to make a clinical difference.
GOALS of CPAP

• Change pressure gradient to force more oxygen into the blood
• Maintain positive pressure in the lungs to force fluid from the lungs
• “Splint” alveoli open to prevent collapse
  – Greater surface area = improved gas exchange
Oxygen Consumption

- 28 Minutes
- 40-50 Minutes
- 4 Hours
- 8 Hours

Cylinders: D, E, M, H
Indications

- Any patient who is in severe respiratory distress with signs and symptoms consistent with asthma, COPD, pulmonary edema, CHF, or pneumonia and who:
  - Is awake and able to follow commands
  - Is over 12 years old and is able to fit the CPAP mask to face
  - Has the ability to maintain an open airway

- AND exhibits two or more of the following:
  - Has a spontaneous RR >25 breaths per minute
  - Has SPO2 <94% at any time
  - Uses accessory muscles during respiration
Contraindications

- Any patient suspected of having a pneumothorax or has suffered trauma to the chest
- Any patient with a tracheostomy
- Any patient who is actively vomiting or has upper GI bleeding
- Any patient with facial trauma or an inability to gain a good seal when attaching mask to face
Application Procedure
Procedure

1. Explain procedure to patient
   - Far better success with explanation and coaching

2. Select the proper size face mask for the patient
   - The circuit comes pre-packaged with a large mask.
   - The medium mask has a sizing tool on the bag
Procedure (continued)

3. Attach the corrugated tube from the circuit to the port on the end of the CPAP generator.
4. Attach the oxygen hose to the CPAP generator.
5. Attach the bacteria filter to the port on the side of the CPAP generator.
**Procedure** (continued)

6. **Attach the oxygen hose to a source.**
   - Any oxygen port in the back of the ambulance
   - The green dongle on the regulator in the oxygen caddy

7. **Apply the mask to the patient’s face.**

8. **Pull the straps around the patient’s head and secure to the bottom of the mask.**
9. Adjust mask position and strap tightness to achieve a seal with minimal air leakage.

10. Secure the CPAP generator to the patient’s arm.
Cautions

• **Watch for gastric distension**
  
  - = Vomiting

• **Watch for hypotension**
  
  - Due to preload/afterload changes

• **Watch for a tension pneumothorax**
  
  - Especially in emphysema patients
Things To Consider

• CPAP **CAN** be used on DNR patients
• The mask can make them claustrophobic...even though they need it. **TALK TO THEM! COACH THEM!**
• If you need a higher FiO2, use blow-by oxygen around the bacteria filter
Parts ‘n Pieces

It's All In Here!

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Parts ‘n Pieces

CPAP Circuit

Medium Mask

CPAP Kit

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Where Do I Plug It In?

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Step 1: Assemble & Plug In
Step 2: Explain The Procedure!
Step 3: Apply To Face

Give The Patient A Chance To Adjust
Step 4: Secure Straps To Mask
Step 5: Pull Straps Until Snug Fit
Hold The Mask Until Both Sides Are Tight
Step 6: Secure The Straps
It's Velcro...Just Push!
Step 7: Secure CPAP To Arm
Step 8: Evaluate
That’s Great... But What If The Patient Needs A Neb?
What About An Inline Neb?

The Only Non-Standard Part
It's On The Top Flap
Make Sure It’s Level

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Questions?