Advent of ALS CPAP

Increased Patient Comfort!

What is CPAP?

Happy Dog, Happy Dog, I’m a Happy Dog!

Why CPAP?

- Mortality $\times 7$
- ETI down 60%


So Easy Even an EMT Can Do It!

Wisconsin BLS CPAP

N = 1910 - 50% Decrease Dyspnea – BORG SCALE NO Intubations
But we are only 10 minutes away!

Study: Average 8 min Transport Treatment Time 28 min

The Respiratory System - Anatomy

Parts is Parts - Oxygenation AND Ventilation

Muscles of Respiration

Inspiration (Think Oxygenation)

- Inspiration is an active process
- Inspiratory muscles contract
- Rib cage rises
- Contracting diaphragm moves inferiorly (down)
- Elastic fibers expand
- Volumes of thorax and lungs increase simultaneously, decreasing the pressure
- Air flows in

Inspiration is an active process requiring muscle contraction
Expiration (Think Ventilation)

• Quiet expiration in healthy people is chiefly passive
• Inspiratory muscles relax
• Rib cage drops under force of gravity
• Relaxing diaphragm moves superiorly (up)
• Elastic fibers in lung recoil
• Volumes of thorax and lungs decrease simultaneously, increasing the pressure
• Air is forced out

Lung Volumes and Capacities

Pneuma
Breath of Life

CO₂ + H₂O → HC₃O⁻ + H⁺
↑ in CO₂ will ↓ pH (blood is more acidic)

Shortness of Breath
Hypoxia OR Hypercapnia

HISTORY and SYMPTOMS

• History of current problem
  • O-P-Q-R-S-T
• Symptoms
  • Pain
  • Severity on Borg Scale
  • Past Medical History

Rapid Cardiopulmonary Assessment

Level of Consciousness (See)
  – Aware of Environment
  – Reaction to Providers
Airway (See)
  – Patent
Breathing (See/Hear)
  – Rate
  – Color
  – Effort
  – Audible Sounds
  – Tidal Volume
Circulation (See/Feel)
  – Peripheral vs.
  – Central Pulses
  – Heart Rate
  – Skin
    • Color, Temp
    • Cap Refill

MODIFIED BORG SCALE FOR GRADING SEVERITY OF DYSPNEA
0 - Nothing at all
1 - Just noticeable
2 - Very slight
3 - Slight
4 - Slight-Moderate
5 - Moderate
6 - Some difficulty
7 - Moderately severe
8 - Severe
9 - Very severe
10 - Panic level - Maximal shortness of breath
SOB
PAST MED

- Provocation
- Associated Chest Pain on Inspiration
- Sputum
- Infectious Symptoms
- Time of Onset
- Medications
- Exertion
- Diagnosis
- Asthma
- Bronchitis
- COPD

Assessment Starts with LOOK
Easy as 1 - 2 - 3!

- Unusual sounds
  - Crowing, gasping, gurgling, wheezing
- Breath sounds by auscultation
- Present? Equal?
  - Adventitious (abnormal)
    - Crackles (rales)
    - Wheezes

LISTEN

Ventricular Gallop

- S3 Gallop
  - "Lub" Gallop
  - "Dub" Gallop

Diastole
Systole

FEEL

- Air movement at the mouth and nose
- Pitting edema of lower extremities and/or sacral area

Signs of Impending Respiratory Failure - LOOK

- Very anxious or significantly altered mental status
- That panicked look - "Please don't let me die!"
- Retractions and/or accessory muscle use
- Nasal flaring
- Absent, minimal or uneven chest rise
- Ashen, Pallor, Cyanosis
- Abdominal breathing
- Breathing rate too rapid or too slow
- Pulse ox reading <90
Signs of Impending Respiratory Failure - LISTEN

- Gurgling, stridor, crowing, snoring
- Decreased breath sounds - Silent chest?
- Wheezing
- Speaks in short phrases, couple words or unable to speak

Signs of Impending Respiratory Failure - FEEL

- Diaphoretic
- Diminished or absent air movement

Goal of CPAP

- To have an effective way to treat CHF/COPD
- Medications are continued throughout patient care

CHF w/ APE
MORTALITY 25%
With CPAP 8%
Decreased ETI 70%

CPAP and Patient Airway Pressure

The application of positive airway pressure throughout the whole respiratory cycle to spontaneously breathing patients.
Alveolar Function and Exchange of Gases

Did you know...

So why does oxygen pass into the blood: Pressure Gradient
Deoxygenated blood has a lower partial pressure of oxygen than alveolar air so oxygen transfers from the air into the blood.

CPAP and Partial Pressure
‘Dalton’s Law
The pressure of a gas mixture is equal to the sum of the partial pressures of its constituents. This allows oxygen into the blood during inspiration and Carbon Dioxide out during expiration.
Example: Air at sea level has a pressure of 760mm Hg. Air is 21% oxygen and 79% nitrogen. 
Partial pressure of oxygen is 760 x 21% = 159mm Hg

CPAP alters the pressure gradient!

Alveolar Function
• The alveoli are the primary constituent of lung tissue where the real work of the lungs is accomplished.
  The elimination of carbon dioxide from the blood in exchange for oxygen.
Respiratory Failure Type II

Public Enemy #1: Asthma

Asthma
- Three S’s
  - Swelling
  - Secretions
  - Spasm
- Lack of cyanosis
- Evidence of accessory muscle use
- “Pursed-lip” breathing (“puffer”)
- Barrel chest
- AP Diameter

#2 Emphysema “Pink Puffers”
- Lack of cyanosis
- Evidence of accessory muscle use
- “Pursed-lip” breathing (“puffer”)
- Barrel chest
- AP Diameter

Chronic Bronchitis “Blue Bloaters”
- Evidence of cyanosis around mouth
- Typically younger in age
- Fluid retention due to right sided heart failure

Alveolar Function
**Beneficial Effects of CPAP**
- Increases pressure within airway.
- Airways at risk for collapse from excess fluid are stented open.
- Alveoli are distended - ↑ surface area for gas exchange

**The primary beneficial effect of CPAP is stenting open of airways**

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**Respiratory Failure Type 1**

**Congestive Heart Failure**

**CHF - Pulmonary Edema occurs...**
- When the left ventricle cannot pump out the amount of blood entering the ventricle
- When the ventricle is damaged and cannot effectively pump enough blood to meet the body's requirements.
- When there is a build up of excess fluid in the body due to kidneys being damaged or not functioning properly due to disease

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**Terms**
- Dyspnea
- Orthopnea
- Paroxysmal Nocturnal Dyspnea

**Patient Assessment - CHF/PE**
- Noisy, labored respirations
- Crackles (rales)
- Skin - Pale/Ashen/Cyanotic & usually diaphoretic
- Tachypnea and Tachycardia
- ↑ work of breathing - retractions, tachypnea
- Severe anxiety/restlessness
- Possible Tripod positioning & Pursed lip breathing
- Coughing with frothy blood-tinges sputum may or may not be present
- JVD & Dependent edema may or may not be present
Treatment Goal
Decrease Myocardial Workload

DEMAND

SUPPLY

Redistribution Of
Extravascular Lung Water
With CPAP


A Note ...

"OLD GEEZERS DON’T BECOME NEW WHEEZERS."

NOT ALL THAT WHEEZES IS ASTHMA!

Preload and Afterload

Preload
Volume of blood in ventricles at end of diastole (not diastolic pressure)

Afterload
Resistance left ventricle must overcome to circulate blood
Increased by hypertension

↑Afterload = ↑Canalic workload

Other conditions in which CPAP may be effective

• Submersion/Drowning
• Smoke Inhalation
• Pneumonia

NOTE: These indications are NOT included in the NYS BLS CPAP Protocol and therefore are not to be used by BLS personnel without contacting Medical Control for Orders
Contraindications

DO NOT USE CPAP

- Patient less than 10 years of age
- Unable to cooperate – Severe altered mental status (Unconscious or GCS <14)
- Decreased mentation (unresponsive to speak, and/or unable to follow commands)
- Systolic BP <90 mm Hg
- High risk of vomiting or aspiration

When Not To Use Mask CPAP

- Hypotension
- Severe facial injuries
- Patients at risk of vomiting

A Prehospital DNR is NOT a contraindication to CPAP use

The Requirements Of CPAP

The real requirement is for Continuous CONSTANT Positive Airway Pressure

- A stable airway pressure as prescribed in order to reduce work of breathing (WOB)
CPAP is oxygen therapy in its most efficient form.

Simple Masks
- Venturi Masks
- Humidifiers
- CPAP

CPAP Systems
- Non-Disposable
- Disposable

Boussignac CPAP

This system uses a lot of oxygen and will use up a full D oxygen tank in about 14 minutes.

*Boussignac “D” Cylinder Depletion Test Results

Q: How long will a cylinder of O2 last using the Boussignac CPAP System?
A: Based on the CPAP level administered (8.5 to 10.0 cm H2O @ 25 lpm) and the corresponding flow rate required using the Boussignac CPAP System, the following chart provides the approximate time that a full cylinder will last:

<table>
<thead>
<tr>
<th>Flow Rate</th>
<th>EMS Portable</th>
<th>EMS Portable</th>
<th>EMS Ambulances</th>
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<td>5</td>
<td>70</td>
<td>103</td>
<td>703</td>
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<td>6</td>
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<td>12</td>
<td>29</td>
<td>44</td>
<td>299</td>
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</tbody>
</table>

This information is taken directly from the Boussignac FAQ found on www.vitaid.com.
Boussignac vs. O2ResQ
Comparison of Oxygen Use

“D” Cylinder O2 Depletion Test Result
O2-RESQ vs. Boussignac

- The elapsed time for the O2-RESQ to run a “D” cylinder completely empty when connected to the DISS fitting on a regulator is 28 minutes.
- The elapsed time for the Boussignac to run a “D” cylinder completely empty when connected to the nipple fitting on a regulator set to 25 LPM, is 14 minutes.

CPAP - Procedure

Standard Precautions
- Gloves
- N95 respirator for any patient suspected of having TB or respiratory infection

Procedure
ALS Intercept

CPAP “virgins” are anxious and fearful, especially if they are hypoxic.

Success is highly dependent on the patient’s tolerance and the EMT’s ability to coach the patient.
Procedure
FIRST THINGS FIRST
Oxygen Source

First Things First

- Oxygen Source

Procedure Application

Indications CPAP is Working

- Reduced heart rate
- Reduced respiratory rate
- Reduced dyspnea/work of breathing
- Increasing SpO2
- Decreasing end-tidal CO2
- Improved mental status
- Ability to speak in longer phrases

Procedure Evaluation

- Monitor
  - CPAP circuit for air leaks
  - Face mask placement for proper fit
  - Patient’s respiratory response to the CPAP
  - Patient’s tolerance
  - Gastric distension
  - Vital signs and SpO2 at least every 5 minutes
- Notify the receiving facility as soon as possible

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Concurrent with CPAP

The following treatments should be done concurrently with CPAP, patient condition permitting (per NYS and AAREMS Protocols):

- High Concentration Oxygen!!!
- Capnography (by ALS, if available)
- Bronchodilator Nebulizer per protocol*
  - Albuterol 2.5 mg (0.83% in 3 cc)
- Additional Medications as per protocol

Nasal cannula with EtCO2 probe placed under CPAP mask
Rescuer CPAP with In-line Nebulizer

In-line nebulizer can easily be placed with the CPAP system.

Boussignac CPAP with Inline Nebulizer

Requires second oxygen source

Contact Medical Control Early Allowing Time for Set-Up in ER

Nebulized Albuterol with Rescuer CPAP

CPAP to BVM!

Documentation
- TIME - CPAP Applied
- Level of CPAP
- FiO2
- SpO2
- Response
- Vital Signs

Don’t FORGET!
Adult Respiratory Distress (non-traumatic/non-pneumothorax)

Request ALS if available.

Do not delay transport to the appropriate hospital.

High risk Conditions:
- Blunt, penetrating chest trauma/
  suspected pneumothorax
- Blunt trauma
- High risk of vomiting or aspiration
- Facial trauma inhibiting mask seal

Initial Assessment

Airway

Obstructed?

No

Allow pt. to maintain position of comfort.

Assist ventilations as needed.

Obtain pulse oximetry baseline readings.

Assess PMH; signs/symptoms, vital signs, ability to speak full sentences, pt. self assessment of severity.

Administer oxygen.

Contraindications:
- Pt. not alert
- Or if MDI is a steroid based medication.

REMAC approved to administer Albuterol Sulfate?

Yes

If pt. is between 1 and 65 yo, administer nebulized Albuterol Sulfate 0.83%, 1 unit dose at 4–6 LPM.

Consider use of CPAP in conjunction with Albuterol Sulfate administration.

If PMH of angina, MI, cardiac arrhythmia or CHF, contact medical control prior to administration.

Exacerbation of previously diagnosed asthma?

No

Signs and symptoms consistent with COPD/Asthma, pulmonary edema or CHF?

If required, after initial treatment is completed, repeat nebulized Albuterol Sulfate once.

Contact medical control if additional treatments are required.

**CPAP CONTRAINDICATION**

< 10 YOA
GCS < 14
Systolic BP < 90
Respiratory arrest or agonal respirations
Blunt, penetrating chest trauma/
suspected pneumothorax
Facial trauma inhibiting mask seal

Yes

Regionally Approved CPAP?

Assess indications for CPAP if pt. does not improve after oxygen administration.

2 or more:

No

Resp. rate > 24/min.

Increased work of breathing

SpO2 < 92%

Skin mottling, pallor or cyanosis

Pulmonary edema or frothy sputum

Yes

Continue transport, re-assessments and supportive care.

Apply CPAP to pt. at 10 cm H2O PEEP.

Sources

- NYS DOH BEMS Policy statement #15-02 – "Continuous Positive Airway Pressure (CPAP) for BLS EMS Agencies"
- NYS DOH BEMS BLS Protocol "Adult Respiratory Distress"
- Finger Lakes Regional EMS Council BLS CPAP Training Outline

Sources


Let’s Be Safe Out There!