

Prehospital Noninvasive Ventilation

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Non-Invasive Positive Pressure Ventilation (NPPV):

- Mask only—no ETT
- **Continuous Positive Airway Pressure:** constant level throughout respiratory cycle
- **Bilevel PAP:** separate settings for inspiration and expiration

Other forms:

- + pressure ventilation via B-V-M: inspiration only; highly variable pressures
- PEEP: Positive end-expiratory pressure only
- PSV: Pressure support ventilation (insp. only)
- PAV: Proportional assist vent. (effort-related)

Normal vs. Supported Ventilation

- Our usual breathing is **NEGATIVE** inspiratory pressure, pulling air and blood flow into chest.
- **POSITIVE pressure ventilation:**
 - pushes air into chest
 - overcomes airway resistance
 - ↑ pulmonary gas exchange
 - keeps alveoli open
 - decreases blood return to heart
 - lowers BP

CPAP/BiPAP Benefits

Mostly hospital studies—CHF and COPD:

- ↑ Alveolar ventilation / oxygenation
- ↓ Work of breathing
- ↓ **Mortality**
- ↓ Morbidity
- ↓ Length of hospital stay
- ↓ **Need for ETT/mechanical ventilation**
- ↓ RR, ↑ TV, ↑ V_E , ↔ V/Q match, ↑ FRC

Prehospital CPAP

Hubble, et al (PEC, 2006):

- 2 similar EMS systems/protocols
- "Pulmonary edema" patients (24% missed Dx)

	<u>CPAP</u>	<u>No CPAP</u>
ETT:	8.9%	25.3%
Mortality:	5.4%	23.2%
RR and P:	better	
Dyspnea:	better	

Use in Respiratory Failure

(hypercarbic*, hypoxic)

- Acute cardiac pulmonary edema*
- COPD exacerbation*
- Asthma
- “Do Not Intubate” patients in resp distress
- Noncardiac PE/ARDS/drowning/smoke
- Pneumonia
- Obstructive sleep apnea
- Hypoventilation with morbid obesity
- Immunocompromised patient
- Trauma (no PTX)
- Cystic fibrosis

*best evidence

Use in Respiratory Failure +

- Subjective:
 - Clinical judgment
 - "Looks bad" / "heading for a tube"
- Objective:
 - Accessory muscle use
 - O₂ sat < 90% (or < 92%)
 - RR > 24
 - Unable to speak full sentences
 - Abdominal/paradoxical breathing
 - Altered mentation

Contraindications

- **Obvious need for ETT: apnea, arrest**
- **Hypotension (< 90 systolic)**
- **Severe AMS (GCS < 11)—judgment call with hypercarbic AMS**
- **Inability to cooperate**
- **Pneumothorax**
- **Facial deformity / trauma / unable to seal**
- **Recent (<1 wk) facial, neurologic, gastric surgery**
- **High risk of aspiration**
- **Unstable cardiac arrhythmia**
- **Caution: Upper airway obstruction / FB**

CPAP devices

- CPAP generator
- Circuit (tubing)
- Interface:
 - Face mask—acute Sx's, mouth breathing
 - Nasal mask—better tolerated, can talk, low risk of aspiration—not for EMS
 - Helmet—better tolerated, can talk, read, drink thru straw, less complications with long use, but can accumulate CO₂, noisy
- Oxygen source
- Bells and whistles (hospital devices)

Use

- **Prep the patient while setting up CPAP**
- **Give necessary meds**
 - Asthma, COPD—nebulizers, etc.
 - Cardiac PE—NTG, furosemide, etc.
- **Apply mask—may have pt hold it at first**
- **Adjust straps for good seal**
- **Reassure patient**
- **Monitor patient status**
- **Alert the receiving hospital**
- **Continue CPAP during transfer of care**

Potential Complications

EMS Concerns:

- Air leak
- Inability to tolerate mask
- Hypotension—rare
- Aspiration if vomiting

Longer use:

- Local skin damage, eye irritation, sinus pain
- Gastric distension—mild, uncommon
- Barotrauma / pneumothorax—rare

CPAP Devices for EMS

- Small, portable, air/O₂ driven
- Fixed or variable pressure, FiO₂
- May drain O₂ tanks fast
- Available for EMS use:
 - Boussignac CPAP
 - PORTO₂ VENT CPAP_{os}
 - Whisperflow Fixed, Variable, Low Flow
 - EzPAP
 - + more

Implementation

- **Protocols**
- **Training**
- **Encouragement of first use on patient**
- **Prep the hospitals—ED needs to have CPAP or BiPAP device**
- **QM**

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