



## **Continuous Positive Airway Pressure (CPAP)**

The training module will follow the national standard curriculum as it relates to the application and use of CPAP. This curriculum, taken from the New York State Pilot Project, uses training programs from the States of Arizona, Pennsylvania and Wisconsin as a model.

### **Course Purpose**

This course is designed to provide instruction in a procedure for the use of the Continuous Positive Airway Pressure Device (CPAP) by the EMT who is approved by their Service Medical Director (SMD) to perform the procedure.

### **Prerequisites**

The EMT participating in this program must:

- be NYS certified;
- be working for an agency who has already been approved or which is seeking approval from the Westchester REMAC to provide this level of care; and
- be approved by the SMD to participate.

### **Methodology**

The following didactic, psychomotor, written and practical evaluation and remediation process shall be utilized to ensure proficiency.

The following is a breakdown of the following recommended minimum hours for training:

- 3 hours Didactic/lecture
- 1 hour- Psychomotor/hand-on practice
- 2 hours Written and skills remediation
- 4 hours Remediation (as needed)

### **Instructor**

The instructor must be an approved Paramedic CIC.



## **Equipment**

The following equipment is required for the course:

- Body Substance Isolation (BSI) equipment
- Pulse Oximeter
- CPAP device with accessories
- Oxygen Cylinder Suction Equipment
- BVM
- ETCO2 Monitor (Optional)

## **Training Course Competencies:**

Upon completion of the course, the student shall be able to:

1. List the indications, contraindications, advantages, and potential complications with the use of CPAP.
2. Identify the equipment required for use of CPAP.
3. Describe and demonstrate Body Substance Isolation (BSI) procedures required for use with CPAP.
4. Describe and demonstrate respiratory assessment and basic airway management techniques.
5. Describe and demonstrate procedures, including preparation of equipment, positioning the patient, for use of CPAP.
6. Demonstrate proper utilization of CPAP device to include:
  - a. Properly sized mask and positioning of mask to include utilization of head straps.
  - b. Titration of PEEP
  - c. Coaching of Patient
  - d. Monitoring of CPAP circuit for air leaks.
  - e. Monitoring the face mask placement for proper fit
  - f. Monitoring the patient's response and tolerance to the CPAP
7. Describe and demonstrate documentation of the CPAP procedures and patient assessment.



## **COURSE OUTLINE**

### **Module One: Lecture**

#### **I. Purpose and Description**

##### **A. Purpose:**

CPAP is a non-invasive means of providing respiratory support for patients who are in enough distress that they need more than supplemental oxygen, but do not yet require intubation. By providing a continuous level of pressure to the lungs through an airtight mask, CPAP has been shown to decrease or delay the need for intubation both in the hospital and in the field. In early published and unpublished studies, CPAP used in the hospital and pre-hospital settings showed more rapid improvement of vital signs (heart rate, respiratory rate, blood pressure) and oxygen saturation versus standard medical therapy alone in pulmonary edema patients.

##### **B. Description:**

CPAP devices deliver continuous positive airway pressure and operator adjustable levels throughout the breathing cycle independent of the patient's flow requirements which assists overcoming airway resistance, keeps alveoli open and improves pulmonary gas exchange in patients with respiratory compromise. Positive pressure ventilation also decreases blood return to the heart and may lower blood pressure.

#### **II. Respiratory Anatomy and Physiology**

##### **A. Anatomy**

1. Nose
2. Nasal Air Passages
3. Mouth
4. Pharynx
5. Glottis
6. Trachea
7. Bronchi
8. Bronchioles and Alveoli

##### **B. Physiology**

1. Pressure changes and ventilation



2. Muscles of respiration a. Compliance
3. Lung volumes and capacities
  - a. Tidal volume
  - b. Inspiratory reserve volume
  - c. Maximum respiration
  - d. Expiratory reserve volume
  - e. Maximum expiration
  - f. Total lung capacity g. Inspiratory capacity
  - g. Functional reserve capacity
  - h. Vital capacity
  - i. Minute volume
4. Exchange and transport of gases in the body
  - a. Diffusion
  - b. Oxygen content of blood
  - c. Carbon dioxide content of blood
  - d. Chemical control of respiration
  - e. Control of respiration by other factors
    - 1) Body temperature
    - 2) Drugs and medications
    - 3) Pain
    - 4) Emotion
    - 5) Sleep

### III. Respiratory Assessment

#### A. Respiratory Assessment

1. LOOK
  - a. Adequate, Equal Expansion of Chest
  - b. Skin Color (cyanosis)
2. LISTEN
  - a. Unusual sounds



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- b. Crowing, gasping, gurgling, wheezing
- c. Breath sounds
  - 1) Present
  - 2) Equal
- 3. FEEL
  - a. Air movement at mouth/nose
- 4. SIGNS OF RESPIRATORY FAILURE
  - a. LOOK
    - 1) Anxious or comatose
    - 2) Absent, minimal or uneven Chest Rise
    - 3) Cyanosis
    - 4) Abdominal breathing
    - 5) Breathing rate is too rapid or too slow
    - 6) Retractions
    - 7) Nasal Flaring
  - b. LISTEN
    - 1) Gurgling, Stridor, Crowing, Snoring
    - 2) Wheezing
    - 3) Speaks in short sentences
    - 4) May be Unable to Speak
  - c. FEEL
    - 1) Diaphoretic
    - 2) Diminished or absent air movement

IV. Review of Disease Processes & Conditions Where CPAP is indicated:

- A. Congestive Heart Failure (CHF)
- B. Pulmonary Edema
- C. COPD
- D. Asthma
- E. Pneumonia



V. Indications:

A. Patients over 10 years of age presenting in acute respiratory distress who are able to follow commands and maintain a patent airway who display findings of any of the following conditions:

1. CHF
2. Pulmonary edema
3. Asthma/COPD
4. Submersion/drowning or smoke inhalation
5. Pneumonia

AND meets two or more of the following criteria:

- Respiratory rate > 24/minute
- Notable increased work of breathing
- SpO<sub>2</sub> < 92% at any time
- Skin mottling, pallor or cyanosis suggesting hypoxia
- Presence of abnormal breath sounds or frothy sputum

VI. Contraindications:

- A. Patients less than 10 years of age
- B. Unconsciousness or GCS < 12
- C. SBP < 90
- D. Respiratory arrest/agonal respirations
- E. Blunt/penetrating chest trauma/suspected pneumothorax
- F. Facial trauma/deformity/burns inhibiting proper mask fit
- G. Recent facial or gastric surgery
- H. High risk of aspiration/active vomiting
- I. Tracheostomy
- J. Pneumothorax



## VII. Special Considerations

- A. CPAP should be discontinued in the case of patient non-tolerance or progression to respiratory failure
- B. CPAP should not delay the administration of medications, e.g., nitro, albuterol, etc.
- C. Advise the receiving facility of initiation of CPAP therapy as soon as practical
- D. Observe patient for signs/symptoms of hypotension, respiratory failure or gastric distension
- E. DNR is not a contraindication to CPAP use

## VIII. Advantages

- A. Provides positive pressure ventilation without the need for intubation
- B. Permits adequate oxygenation with lower FIO<sub>2</sub>
- C. Avoidance of risk, complications, and expense of ET intubation
- D. Decreases the need for sedation/paralytics
- E. Decreases the risk of nasocomial infections
- F. Preservation of speech
- G. Patient can swallow, eat and drink
- H. Preservation of normal airway defense mechanisms
- I. In COPD patients may reduce the need for ETT in as much as 80% of patients
- J. Nasal mask CPAP has been shown effective in elderly patients with acute respiratory failure to avoid intubation

## IX. Complications

- A. Heightened sense of claustrophobia or smothering
- B. Abrasions to the bridge of the nose
- C. Significant mask leak may lead to rapid life threatening hypoxemia
- D. Patient discomfort
- E. Loss of definitive control of airway and breathing
- F. Aerophagia (less common)
- G. Impaired access to airway for suctioning (less common)
- H. Facial skin pressure stress (long term use)



- I. High external pressures may increase intrathoracic pressures thus decreasing venous return and decreasing cardiac output (rare complication)
- J. Potential for barotraumas, pneumothorax or pneumomediastinum (rare complication)
- K. Potential for aspiration, gastric distention and inability to clear secretions (rare complication)

#### X. Limitations

- A. Intermittent use of diuretics is required in CHF patients
- B. Positive pressure ventilation can only decrease consequences of hypoxemia and decrease need of high concentration of O<sub>2</sub>. It does not preclude poor outcomes due to other systemic disturbances
- C. Only an alternative to standard mechanical ventilation system

#### XI. Precautions

- A. Mechanical ventilation and intubation remains the mainstay of treatment for patient with persistent hypoxia or respiratory muscle fatigue
- B. Intubation should be available for patients who do not respond to non-invasive positive pressure ventilation

#### XII. Procedure:

- A. Demonstrate Body Substance Isolation (BSI) procedures.
- B. Assemble and prepare the equipment.
  - 1. Prepare CPAP equipment and adequate oxygen supply
  - 2. Explain the CPAP procedure to the patient
  - 3. Place the patient in a high fowler's position
  - 4. Place SPO<sub>2</sub> monitoring device
  - 5. Place ETCO<sub>2</sub> detector on face if available, get initial reading
  - 6. Check CPAP for oxygen flow, dial up for flow, then turn off
  - 7. Have patient hold CPAP mask in proper position with proper force
  - 8. Dial up to a PEEP starting at 10 cm H<sub>2</sub>O
  - 9. Coach the patient how to breath and to relax
    - a. Use verbal sedation, coach the patient throughout the transport





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- b. "You are going to feel better from the pressure of the mask"
  - c. "Breathe in slowly through your nose. Exhale slowly through your mouth"
  - d. EMT counts aloud 1,2,3,4 during patients exhalation
10. Place the head straps if patient will allow them to be used
  11. Monitor the CPAP circuit for air leaks
  12. Monitor the face mask placement for proper fit
  13. Monitor the patient's respiratory response to the CPAP
  14. Monitor the patient's tolerance
  15. Monitor and record the patient's vital signs every 5 minutes
  16. Administer medications as appropriate per patient condition (i.e. administration of Albuterol using the SVN inline configuration, Nitro tablets as indicated, BP > 100 Systolic)
  17. Monitor for gastric distention
  18. Notify receiving facility and advise that CPAP is in use

C. Special Notes

1. Remove the CPAP if the following situations occur:
  - a. The patient level of consciousness deteriorates, cannot follow commands.
  - b. The patient becomes unresponsive.
  - c. The patients respiratory status declines, cannot maintain airway.
  - d. The patient degrades to agonal respiratory effort or apnea.
  - e. The patient develops active vomiting.
  - f. The patient develops active upper GI bleeding.
  - g. The patient becomes claustrophobic and cannot tolerate the mask.
  - h. The patient develops acute gastric distention that is impairing respiratory effort.
  - i. The patient's blood pressure drops below 90 systolic.
  - j. The hospital cardio-pulmonary staff is prepared to immediately transfer the CPAP care.



D. Post CPAP removal:

1. Prepare for possible airway management with Bag Valve Mask (BVM) device assistance.
2. Prepare for possible endotracheal intubation, then gastric decompression if needed.

E. Transition at the Emergency Department:

Sudden removal of CPAP on arrival at the ED is risky, so it should be continued until the patient clearly stabilized. It is important to give enough notification to the emergency department so that they can notify respiratory therapy. The in-hospital CPAP and BiPAP devices are more complicated and require more setup time. CPAP will drain the D sized cylinders more rapidly. Be prepared to access the wall mounted oxygen sources in the emergency department.

F. Troubleshooting:

*Warning: Transport of patients with CPAP requires the certified EMT have a good working knowledge of the device's use and problem solution. Proper emergency backup equipment or other means of positive-pressure ventilation device must be immediately available during transport.*

Indication

Probable Cause

Solution

Low pressure; unable to maintain above 10 cm H<sub>2</sub>O and inadequate patient respiratory response

Low supply of Oxygen

Always make sure an adequate supply of oxygen is available for patient use and transport

Mask seal

Check for proper mask size and seal; especially at bridge of nose

Leak in the breathing circuit

Disconnect the breathing circuit; assist oxygenation and ventilation as necessary

High pressure; gastric distention and inadequate respiratory response



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Blocked airway; secretion or control module setting above 10 cm H<sub>2</sub>O  
Position airway; consider suctioning and check the control module setting  
and adjust as required

Failure to respond to treatment of CPAP,

Response should be to assist oxygenation and ventilation as necessary via  
other means.

### XIII. Documentation

- A. Circumstances contributing to the decision for using CPAP.
- B. Procedure, patient assessment and outcome



## Module Two

### I. Psychomotor Skills

- A. Given the equipment to be used, the student will practice the proper technique for using Continuous Positive Airway Pressure (CPAP)
- B. Given the equipment to be used, in a one on one situation, the instructor will guide the student to perform the skill to proficiency.
- C. In a one on one situation, the instructor will use the two scenarios which meet the following criteria:
  1. There is an indication for use of CPAP.
  2. The device fails to operate properly.
  3. How to troubleshoot the CPAP Device.

*Note: The student must identify each situation correctly and perform the indicated tasks appropriately.*

### II. Written Evaluation (see attached sample test)

Administer a written evaluation completed with 80% competency.

### III. Psychomotor Skills Evaluation (see attached sample skills evaluation)

- A. Using the attached practical skills sheet evaluation, the student will correctly use the
- B. CPAP with 80% competency; no failure of critical criteria.
- C. When conducting the practical testing the following conditions must be maintained:
  1. The practical exam must be conducted in a testing environment. The students must understand that they are being evaluated. Corrective guidance during the evaluation is not permitted.
  2. The evaluator must not reveal the specific criteria for failure.
  3. The student will be allowed three (3) attempts to perform the practical skills for evaluation of the utilization of Continuous Positive Airway Pressure (CPAP) with 80% competency; no failure of critical criteria.
  4. Students who fail will go through another training session and or a remediation process.