NON-INVASIVE VENTILATION – (NIV)

FOR USE ONLY IF SPECIFICALLY INCLUDED WITHIN THE APPROVED SCOPE OF PRACTICE OF THE PROVIDER

Acute non-invasive ventilation (NIV) involves providing respiratory support through a tight-fitting mask, which is usually applied around the patient's mouth and nose. It may take the form of continuous positive airway pressure (CPAP) or bilevel inspiratory positive airway pressure (BiPAP). Acute NIV is usually used in hospital but can be administered enroute to hospital. CPAP is simpler to use and thus more suitable for pre-hospital care. Acute respiratory failure is often associated with elevated carbon dioxide levels and acidosis, in addition to hypoxia. In patients with chronic respiratory disease, oxygen therapy may reduce respiratory drive and worsen hypercapnia and thus outcome. BiPAP can improve gas exchange and outcome in these circumstances.

NIV Continuous Positive Airway Pressure (CPAP) and Bilevel Inspiratory Positive Airway Pressure (BiPAP) have been shown to rapidly improve vital signs, gas exchange, work of breathing, decrease the sense of dyspnea, and decrease the need for endotracheal intubation in certain patients who suffer respiratory distress from CHF, pulmonary edema, asthma, COPD, or pneumonia. In patients with CHF, CPAP can improve hemodynamics by reducing preload and afterload, however it may cause hypotension.

Continuous Positive Airway Pressure (CPAP)

A. INDICATIONS: When tolerated by the patient, CPAP is most effective in treating hypoxic respiratory failure. Any patient who is in respiratory distress with hypoxia and who has signs and symptoms consistent **with at least one of the following**: CHF, pulmonary edema, asthma, COPD, or pneumonia **AND must meet all five (5) of the following criteria:**

1. Is awake and oriented.

    a. If after 3 to 5 minutes the patient does not respond, cannot tolerate CPAP, or their condition worsens then the CPAP will be disconnected and patient will receive a trial of Bi-PAP, PPV, or BVM and consider intubation to protect the airway. Refer to protocol 4901 (Airway Management).

2. Is over 12 years old and is able to fit the CPAP mask.

3. Has the ability to maintain an open airway (GCS >10).

4. Has a systolic blood pressure > 90 mm Hg.

5. Has **at least two (2)** or more of the following:

a. Retractions or accessory muscle use.

b. Respiratory > 24 per minute.

c. Inability to speak in full sentences due to dyspnea.

B. CONTRAINDICATIONS **(Do not use if any are present):**

1. Respiratory arrest.
2. Hypercapnic respiratory failure (See BiPAP)
3. Hypotension (Blood pressure < 90 systolic).
4. Suspected pneumothorax.
5. Patient has a tracheostomy.
6. Foreign body airway obstruction.
7. Facial deformity or trauma causing inability to achieve mask seal.
8. Actively vomiting.
9. Recent facial, neurological, or gastric surgery.
10. Chest, head, or face trauma.

C. COMPLICATIONS:

1. Tension pneumothorax
2. Hypotension
3. Aspiration
4. Gastric distention
5. Severe anxiety / combativeness due to mask intolerance.

D. PROCEDURE:

1. Explain the procedure to the patient.
2. Continuously monitor patient.

a. Check and document vital signs every five (5) minutes.

b. Observe for decrease in level of consciousness.

c. Observe for gastric distention.

3. Continuously monitor pulse oximeter.

4. Ensure adequate oxygen supply to the CPAP device.

5. Turn CPAP device on.

6. Have the patient sit up as much as possible.

7. Apply the device as per manufacturer's directions.

8. Initially assist the patient in holding the mask tightly to their face and evaluate their tolerance of the mask.

9. Reevaluate patient's condition and tolerance of the mask:

a. Coach the patient to keep mask in place and readjust, as needed.

b. If respiratory status or level of consciousness deteriorates, remove device, assist ventilations, and utilize appropriate airway management modality as per protocol.

c. If patient tolerates mask and condition does not deteriorate, secure the mask with straps.

10. Check for air leaks.

11. Continue to monitor the patient during transport.

12. Contact **Medical Command,** as early as possible, so the receiving hospital can be prepared for the patient.

E. REMOVAL: CPAP should be continuous and should not be removed in the prehospital setting unless:

1. Patient cannot tolerate the mask.

2. Patient begins to vomit.

3. Patient's mental or respiratory status deteriorates.

4. Patient becomes hypotensive (Systolic blood pressure < 90 or drops 20 mm/Hg).

Notes:

1. CPAP should continue upon arrival at the emergency department until patient care is transferred to the emergency department staff. Do not remove CPAP until hospital emergency therapy is ready to be placed on the patient.

2. This procedure may be performed on a patient with a *Do Not Resuscitate order*.

3. CPAP pressure should be started at 3 - 5 cm of H20. Most patients will only require 5 cm H20. Pressure may be slowly titrated upward depending on patient response, BUT NEVER ABOVE 10 cm H2O without MCP order.

4. CPAP should be used with caution with portable oxygen systems due to limited amounts of oxygen available to operate the device (If CPAP device is oxygen powered).

5. **DO NOT** delay other emergency interventions to establish CPAP. CPAP should be delivered as an adjunct to treatments indicated by the primary protocol.

6. Most patients will improve in 5 - 10 minutes. If no improvement within this time, consider additional treatment options per primary protocol.

7. **DO NOT** force CPAP use on patients who have failed at past attempts to utilize noninvasive ventilation techniques and request that it not be applied.

Bilevel Inspiratory Positive Airway Pressure (BiPAP)

A. INDICATIONS: BiPAP is particularly effective when treating hypercapnic respiratory failure with associated respiratory acidosis (ETCO2 >45). Any patient who is in respiratory distress with hypoxia or hypercapnia and who has signs and symptoms consistent **with at least one of the following**: asthma, COPD, pneumonia, CHF, or pulmonary edema **AND must meet all five (5) of the following criteria:**

1. Is awake and oriented.

    a. Exception to this would be if you had the optional ability to continuously monitor and trend ETCO2 values and waveform and MUST remain with the patient at all times.

    b. If the patient has an altered LOC caused from hypercapnia, then BiPAP may be applied and patient continually reassessed for a decrease in the ETCO2 and improvement in oxygenation as evidenced by an increase in the SPO2, level of consciousness and decrease in the ETCO2.

    c. If after 3 to 5 minutes the patient does not respond, or their condition worsens then the BiPAP will be disconnected, and patient will receive PPV or BVM and consider intubation to protect the airway. Refer to protocol 4901 (Airway Management)

2. Is over 12 years old and is able to fit the BiPAP mask (unless appropriate fitting mask is available as in the situation of and interfacility transfer).

3. Has the ability to maintain an open airway (GCS >10).

4. Has a systolic blood pressure > 90 mm Hg.

5. Has **at least two (2)** or more of the following:

    a. Retractions or accessory muscle use.

    b. Respiratory > 24 per minute.

    c. Inability to speak in full sentences due to dyspnea.

B. CONTRAINDICATIONS **(Do not use if any are present):**

1. Respiratory arrest.

2. Hypotension (Blood pressure < 90 systolic).

3. Suspected pneumothorax.
4. Patient has a tracheostomy.
5. Foreign body airway obstruction.
6. Facial deformity or trauma causing inability to achieve mask seal.
7. Actively vomiting.
8. Recent facial, neurological, or gastric surgery.
9. Chest, head, or face trauma.

C. COMPLICATIONS:

1. Tension pneumothorax
2. Hypotension
3. Aspiration
4. Gastric distention
5. Severe anxiety / combativeness due to mask intolerance.

D. PROCEDURE:

1. Explain the procedure to the patient.
2. Assure a patent airway.
3. Ensure emergency equipment is immediately available and an alternative management plan has been established.
4. Continuously monitor patient.
   a. Check and document vital signs every five (5) minutes.
   b. Observe for decrease in level of consciousness.
   c. Observe for gastric distention.
   d. Continuously monitor pulse oximeter and ETCO2 monitoring (nasal prong

devices can be utilized as long as they do not compromise a good mask seal.

5. Ensure adequate oxygen supply to the BiPAP device.

6. Turn BiPAP device on.

7. Have the patient sit up as much as possible.

8. Apply the device as per manufacturer's directions.

9. Field Procedure: Set initial inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP) to decrease patient respiratory effort and adjust as needed.

   a. Start with EPAP at 5 cmH2O (max 8 cmH2O) (Adult)

   b. Start IPAP at 10 cmH2O (max 15 cmH2O) (Adult)

   c. IPAP is increased in steps of 2 cmH2O every 10 minutes to the max listed above as needed till patient improvement.

   d. EPAP is increased in steps of 2 cmH2O every 10 minutes to max listed above as needed for an oxygen saturation >93%.

   e. Do not exceed above maximums without MCP order.

   f. Pediatric NIV setting should be established through contact with MCP based upon the following:

Age	EPAP Max	IPAP (5-10cm H20 over EPAP)
Infant	7-8cm H20	12-18cmH20
Toddler	8-10cm H20	13-20cmH20
Adolescent	10-12cm H20	15-20cmH20

10. Interfacility Transfer Procedure:

    a. Set EPAP and IPAP to current settings if patient is tolerating them.

    b. If patient is not tolerating the current settings consult referring physician and respiratory therapist or contact MCP.

11. Initially assist the patient in holding the mask tightly to their face and evaluate their tolerance of the mask.

12. Reevaluate patient's condition and tolerance of the mask:

    a. Coach the patient to keep mask in place and readjust, as needed.

    b. If respiratory status or level of consciousness deteriorates, remove device, assist ventilations, and utilize appropriate airway management modality as per protocol.

    c. If patient tolerates mask and condition does not deteriorate, secure the mask with straps.

13. Check for air leaks.

14. Continue to monitor the patient during transport.

15. Contact **Medical Command,** as early as possible, so the receiving hospital can be prepared for the patient.

E. REMOVAL: BiPAP should be continuous and should not be removed in the prehospital setting unless:

1. Patient cannot tolerate the mask.

2. Patient begins to vomit.

3. Patient's mental or respiratory status deteriorates.

4. Patient becomes hypotensive (Systolic blood pressure < 90 or drops 20 mm/Hg).

Notes:

1. While both CPAP and BiPAP can be used to treat hypoxic respiratory failure, BiPAP is most effective at treating hypercapnic respiratory failure. BiPAP is essentially interchangeable with indications for CPAP but CPAP is not interchangeable with BiPAP when it comes to the treatment of hypercapnic respiratory failure.

2. BiPAP should continue upon arrival at the emergency department until patient care is transferred to the emergency department staff. Do not remove BiPAP until hospital emergency therapy is ready to be placed on the patient.

3. This procedure may be performed on a patient with a *Do Not Resuscitate order*.

4. BiPAP should be used with caution with portable oxygen systems due to limited amounts of oxygen available to operate the device (If BiPAP device is oxygen powered).

5. **DO NOT** delay other emergency interventions to establish BiPAP. BiPAP should be delivered as an adjunct to treatments indicated by the primary protocol.

6. Most patients will improve in 5 - 10 minutes. If no improvement within this time, consider additional treatment options per primary protocol.

7. **DO NOT** force BiPAP use on patients who have failed at past attempts to utilize noninvasive ventilation techniques and request that it not be applied.