



**REGION 11  
CHICAGO EMS SYSTEM  
PROCEDURE**

Title: Nasal Cannula Capnography - ALS

Section: Airway/Ventilatory Management

Approved: EMS Medical Directors Consortium

Effective Date: June 1, 2026

## **NASAL CANNULA CAPNOGRAPHY (NCC) - ALS**

### DEFINITIONS

**Capnography:** Analysis of carbon dioxide (CO<sub>2</sub>) concentrations in respiratory gases by continuous waveform.

**End-Tidal CO<sub>2</sub> (ETCO<sub>2</sub>):** Amount of carbon dioxide measured at the end of exhalation.

### INDICATIONS

**In spontaneously breathing patients without an advanced airway, NCC should be used for patients with:**

- Altered mental status including suspected opiate overdose
- Respiratory distress
- Sedating medications (fentanyl and midazolam) with altered mental status
- Sepsis or septic shock
- Suspected diabetic ketoacidosis (DKA)

### CONTRAINDICATIONS

None

### EQUIPMENT

- Cardiac monitor
- Microstream CO<sub>2</sub> sampling nasal cannula capnography oxygen tubing (adult or pediatric size)

### PROCEDURE

1. Apply personal protective equipment: gloves.
2. Attach sampling tube to cardiac monitor CO<sub>2</sub> intake and activate sampling mode by pressing the Zoll X series monitor's CO<sub>2</sub> quick access key. This will zero the device to ensure an accurate reading.
3. Place Microstream nasal cannula on adult or pediatric patient.
4. Verify that the capnography display appears and allow three seconds for accurate reading.
5. Note capnography numerical reading, waveform, and respiratory rate per minute (Breathing Rate – BR).
6. Attach oxygen tubing port to oxygen source and set to desired flow rate as needed (only patients that are hypoxic less than 94% should have oxygen administered, oxygen is not required for capnography use).
7. Document procedure, numeric values and attach capnography file to the electronic patient care report.
8. Monitor patient's oxygen saturation, breath sounds, chest wall movement, respiratory rate, capnography.



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CAPNOGRAPHY GUIDELINES

1. **Ventilation** is an active process, assessed with end-tidal CO<sub>2</sub>. End-tidal CO<sub>2</sub> measurement is an indication of air movement in and out of the lungs. The normal value of exhaled CO<sub>2</sub> is 35-45mmHg.
2. **Oxygenation** is a passive process, which occurs by diffusion of oxygen across the alveolar membrane into the blood. The amount of oxygen available in blood is assessed with pulse oximetry.
3. Capnography provides both a specific value for ETCO<sub>2</sub> measurement and a continuous waveform representing the amount of CO<sub>2</sub> in the exhaled air.
4. Nasal cannula capnography (NCC) can measure end-tidal CO<sub>2</sub> in the spontaneously breathing patient for:
  - a. Altered mental status – Patients with altered mental status, including those with alcohol intoxication, intentional or unintentional drug overdose, head injury, and seizure or postictal patients (especially those treated with benzodiazepines) may have impaired ventilatory function. Capnography can differentiate between patients with effective ventilation. Patients with ineffective ventilation will need an intervention of positive pressure ventilation with bag-valve-mask (BVM) or administration of naloxone if suspecting opiate overdose. For patients with suspected opioid overdose who are protecting their airway, a normal ETCO<sub>2</sub> and oxygen saturation (>94%) may not require naloxone.
  - b. Respiratory distress – Capnography provides dynamic monitoring of ventilatory status in patients with acute respiratory distress from any cause including bronchospasm (from asthma or COPD) or pulmonary edema (from congestive heart failure). By measuring the end-tidal CO<sub>2</sub> and respiratory rate for each breath, capnography provides immediate feedback on the clinical status of the patient. EMS clinicians can rapidly assess trends in patient status to determine the effects of interventions and assess for bronchospasm or air trapping. An increasing end-tidal CO<sub>2</sub> indicates a patient's ventilations are worsening despite treatment and a decreasing end-tidal CO<sub>2</sub> indicates a patient's ventilations are improving with treatment.
  - c. Sedating medications (fentanyl or midazolam) – Continuous capnography monitoring should be initiated in all patients with sedating medication use (fentanyl or midazolam) **and altered mental status** to rapidly detect adverse airway or respiratory events including respiratory depression, apnea, upper airway obstruction, laryngospasm, or bronchospasm. Patients monitored with capnography experience fewer episodes of hypoxia than those monitored without this tool.
  - d. Sepsis or septic shock – ETCO<sub>2</sub> has an inverse relationship with lactate for severe sepsis and septic shock. Patients with a high lactate and severe sepsis may have a low ETCO<sub>2</sub> value of less than 25 mmHg, which is a critical finding.
  - e. Suspected diabetic ketoacidosis (DKA) – There is a positive correlation between serum bicarbonate (HCO<sub>3</sub>) and ETCO<sub>2</sub> in diabetic ketoacidosis. As the patient becomes acidotic, HCO<sub>3</sub> decreases causing an increase in ventilation to compensate, causing decreased ETCO<sub>2</sub> values with high respiratory rates.

**Nasal Cannula Capnography Table**

<b>ETCO<sub>2</sub> Reading</b>	<b>Cause</b>	<b>Clinical Intervention</b>
<b>ETCO<sub>2</sub> High</b>	Altered mental status, respiratory distress, sedating medications with hypoventilation	Positive pressure ventilations (BVM, CPAP)
<b>ETCO<sub>2</sub> Low</b>	Sepsis, septic shock, DKA	Fluid resuscitation



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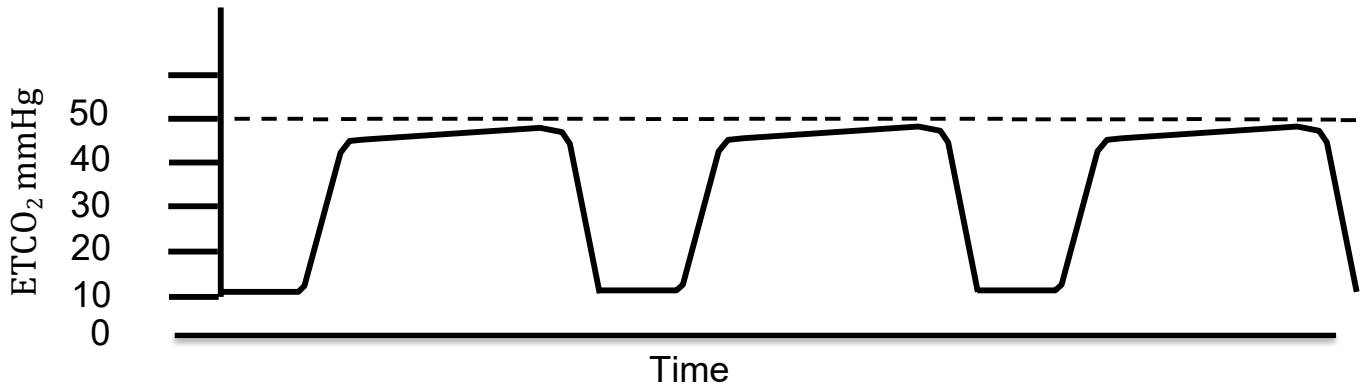
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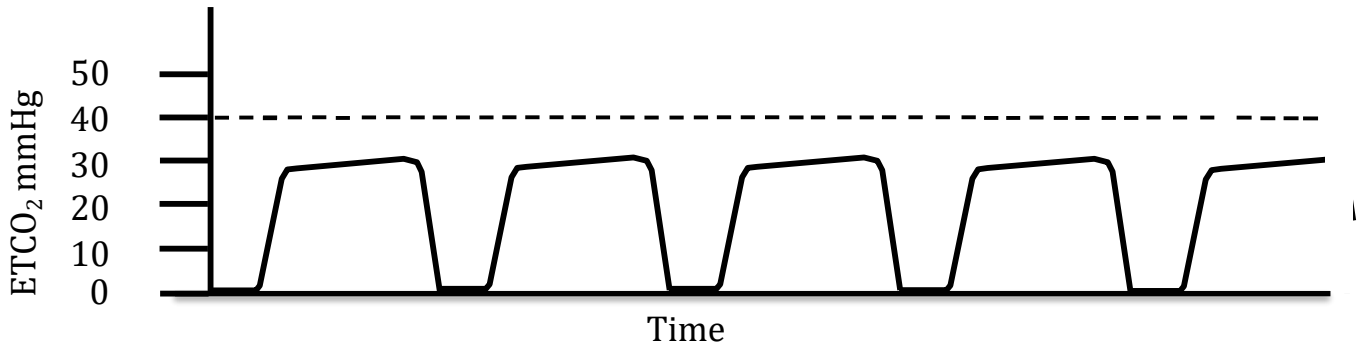
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CAPNOGRAPHY WAVEFORMS

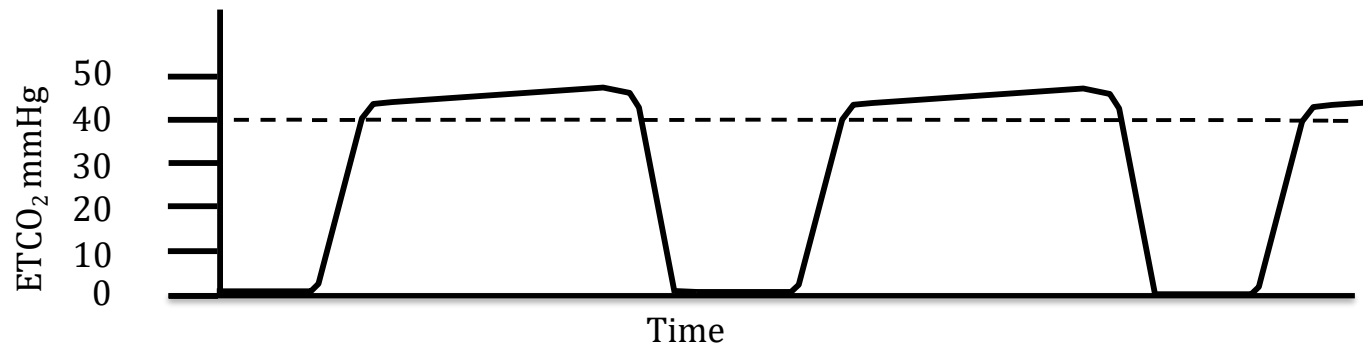
Normal shape of the capnograph



Hyperventilation (Normal waveform with reduced height, <35mmHg, and high ventilation rate)



Hypoventilation / Bradypnea (Normal waveform with increased height, >45mmHg)





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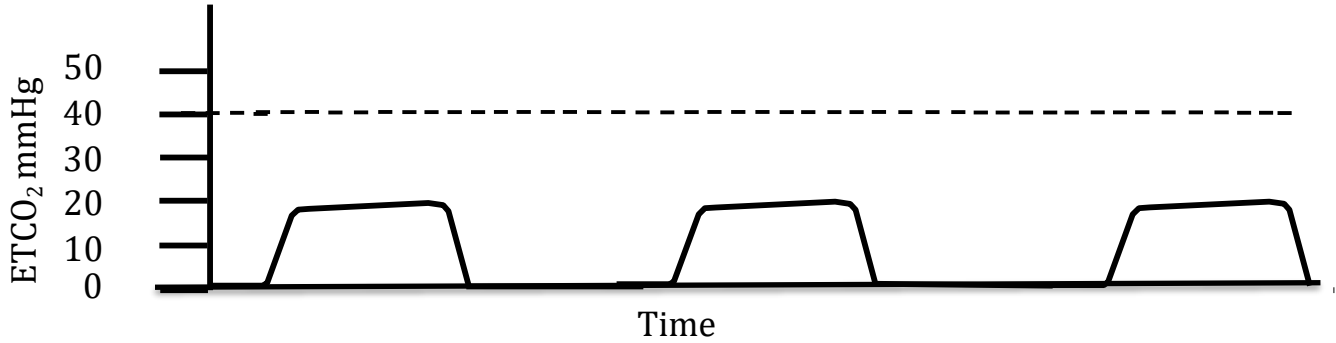
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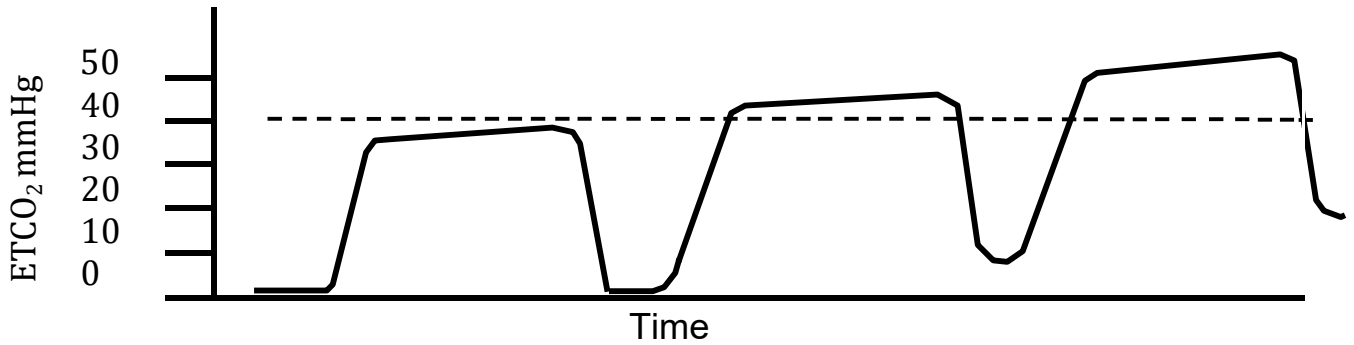
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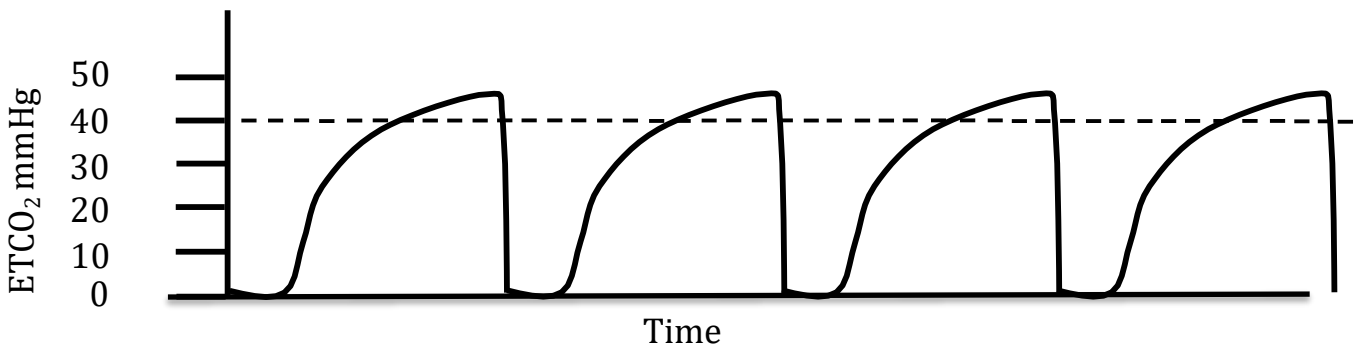
Hypoventilation / Low tidal volumes/shock (Normal waveform with reduced height, slow ventilation rate)



Air Trapping / Breath Stacking (Box wave forms that show increasing values with each successive breath)



Bronchospasm ("Shark Fin Pattern")



Progressive Hypotension or Re-arrest (Progressive decrease in values with each successive breath)

