**Policy Rationale and Text**

One of the main functions of human respiration is the removal of Carbon dioxide (CO₂). Accurate real-time information on CO₂ levels can be helpful in assessing the adequacy of ventilation and perfusion. Capnography is a non-invasive, feasible and practical approach to monitor CO₂ ventilation during exhalation in real time. It can be done for a short period of time or continuously, both in mechanically ventilated and non-ventilated patients. End Tidal CO₂ (EtCO₂) is the numeric measurement at the end of exhalation and identifies the highest peak of CO₂ concentration in the exhaled air.

The purpose of this policy is to provide guidelines for Capnography (EtCO₂) monitoring in University Hospital Zale-Lipsy. The goal is to ensure safe and correct use of EtCO₂ monitors in eligible patients to allow providers, registered nurses (RNs) and respiratory therapists (RTs) to assess the quality of ventilation and early detection of possible respiratory or hemodynamic compromise.

Capnography monitoring will be used for non-intubated patients receiving procedural sedation, post sedation monitoring, and continuous Intravenous (IV) and/or epidural infusions of opioids or sedatives and at the discretion of the RN or RT for concerns of compromised respiratory status. Capnography monitoring will also be used in intubated patients (see indications listed below).

**Scope**

This policy applies to all patient care providers, specifically Critical Care Intensivists and/or other Critical Care Providers, Anesthesiologists, Registered Nurses (RN) and Respiratory Therapists (RT) working in University Hospital Zale-Lipsy.
Capnography monitoring will be initiated by RNs and/or RTs when the following indications are present.

- Intubated patients including, but not limited to:
  - Verification of artificial airway placement (Colorimetric vs Capnographic method)
  - Assessment of pulmonary circulation and respiratory status
  - Optimization of mechanical ventilation
  - Neurologically critically ill patients with cerebral edema or elevated intracranial pressure
  - During transport (if available)

- Non intubated patients that include:
  - Patients receiving moderate sedation/analgesia during a procedure
  - Patients receiving PCA opioids
  - Patients receiving epidural opioids
  - Patients receiving a continuous infusion of opioids or sedative/hypnotic agents
  - Clinical presentations:
    - Altered mental status
    - Respiratory distress
    - Known history of pulmonary disease or sleep apnea
    - Recent history of respiratory failure or risk of impending respiratory failure (e.g. Myasthenic crisis)
    - Geriatric patients with complex co-morbidities
    - Morbidly obese patients, BMI > 40, at risk of obstructive sleep apnea

**DESCRIPTION OF PROCEDURE**

**Pre-Procedure:**

1. Connect the EtCO2 module to the physiologic bedside monitor or PCA IV module as appropriate.
2. Attach the Capnoline sampling cannula to the module and place cannula on patient (with or without oxygen, as required)
3. For patients on a ventilator, attach the Filterline sampling cannula to the monitor and the ventilator tubing sampling port.
4. Instruct the patient and family on the purpose of the cannula and the EtCO2 monitor. Document this instruction in the patient’s electronic medical record.
5. If patient requires oxygen, it may be delivered through the Capnoline up to a maximum of 5 liters/minute.
6. Document the baseline value and monitor the capnography waveform, respiratory rate, EtCO2 level and high/low alarm limits as available per physiologic monitoring device.

**Intra-Procedure:**

- Alarm values for ETCO2 monitoring:
  - Default limits for ETCO2 are set at 25 and 50mmHg
  - Default respiratory rate limits are set at 10 and 30 breaths per minute.
  - The default limits may be changed upon a provider’s order based on individual circumstances
Monitoring duration, frequency, and documentation:

- Patients requiring short term conscious sedation or procedural sedation:
  - Blood pressure (BP), SaO2, heart rate and capnography will be monitored and documented at baseline, a minimum of every 5 minutes or additionally as needed during the procedure.
  - ETCO2 monitoring will be in place during procedural sedation and for two hours after the last dose of sedation, or until the patient has returned to baseline, as defined by baseline level of consciousness, respiratory rate, blood pressure and heart rate, SaO2 and ETCO2.

- For patients on PCA, continuous opioid, or benzodiazepine infusions:
  - Baseline level of consciousness, blood pressure (BP), SaO2, heart rate and capnography will be obtained prior to sedation/opioid infusion initiation. These parameters will be monitored and documented every 30 minutes until the patient is hemodynamically, then every hour until satisfactory pain, sedation, and EtCO2 values are achieved. Then documented at a minimum of every 4 hours for the duration of therapy, or additionally if needed. ETCO2 monitoring is continuous, however, it may be suspended if the patient is eating or ambulating. Resume monitoring when activity is completed.

- Mechanically ventilated patients: Capnography will be continuously monitored and recorded with all other vital signs documentation.

The provider will be notified of changes in the patient’s respiratory status which may include but are not limited to:

- Physiologic monitor alarm alerts for:
  - Apnea/No breath alarm
  - Low or high ETCO2 limits
  - Low or high respiratory rate
  - Change of +/- 10 mmHg ETCO2 from baseline value
  - Loss of ETCO2 waveform.

Responsibilities

RNs and/or RTs will initiate EtCO2 monitoring for the patient indications referenced above and notify Provider, who will write a corresponding order. RNs will notify the Provider, if the ETCO2 values are outside the pre-specified range, if the waveform is lost, or if the morphology of the waveform is abnormal. Orders should be placed by the Provider for a baseline arterial blood gas (ABG) sample to determine the initial correlation between arterial pCO2 and ETCO2. RNs/RTs will document values as described above and notify Provider of changes as described above.

Definitions

Capnography: a non-invasive method for monitoring the level of CO2 in exhaled breath to assess a patient’s ventilator status. It includes the numeric value of the CO2 level and the waveform through the ventilation cycle.

EtCO2/End Tidal CO2: A numeric measurement of CO2 concentration at the very end of expiration.

Mainstream CO2 sensors: Sensors are placed in direct tubing on the path to the ventilator.

Sidestream CO2 sensors: Sensors are located away from the direct airway tubing rather side circuit with a pump transport exhaled air to the sensor.
**Capnoline:** Nasal cannula that allows sampling of the ET\textsubscript{CO\textsubscript{2}} and can also deliver oxygen to the patient.

**Filterline:** Tubing that is placed in the ventilator circuit that allows continuous sampling of the ET\textsubscript{CO\textsubscript{2}}.

### Related Statutes, Other Policies, Requirements, or Standards

### REFERENCES


Faarc IMC, Rrt-nps TRM, From C. Should Every Mechanically Ventilated Patient Be Monitored With Capnography From Intubation to Extubation? Minimizing the Duration of Mechanical Ventilation. 2007:423-442.


[OPTIONAL: SPECIAL INSTRUCTIONS FOR INITIAL IMPLEMENTATION, ETC.]

[OPTIONAL: FORMS, TOOLS, OR ONLINE PROCESSES]

[OPTIONAL: EXCEPTIONS]

[OPTIONAL: APPENDIX]

Guide to Capnography/EtCO\textsubscript{2} waveform (Appendix)

### WEBSITE ADDRESS FOR THIS POLICY