Title: Adult Patient-Controlled Analgesia and Capnography (EtCO$_2$) Monitoring

Effective Date: 12-09-2013  
Review Date: 12-12-2013  
Revised Date: 12-12-2013  
Supersedes:  
Issuing Authority: Pharmacy  
Responsible Leader: VP Pharmacy, VP Clinical Quality & Safety

Purpose:
To establish and implement processes for safe utilization of Patient-Controlled Analgesia (PCA) opioid infusions including monitoring of continuous End Tidal Carbon Dioxide Levels (Capnography, ETCO2) in hospitalized adult patients receiving pain management via PCA.

Definitions: (See entire definition section at end of policy)  
**Patient-controlled analgesia (PCA)** is a self-administrated, drug delivery system enabling a patient to be in control of delivery of a predetermined dose of IV analgesia by pressing a button.

**Capnography, End-tidal carbon dioxide monitoring (ETCO2)** determines the carbon dioxide (CO2) concentration in exhaled gas, providing information about an individual’s pulmonary, cardiac, and metabolic status. Such information aids patient management and helps prevent clinical compromise due to respiratory depressant effects of medications.

Scope Of Policy
Policy applies to coworkers and credentialed providers who are performing activities or services for Mercy hospitalized patients receiving PCA opioid infusions and capnography monitoring.

Policy:
Continuous End Tidal Carbon Dioxide Levels (Capnography, ETCO2) monitoring is required for all hospitalized adult patients receiving pain management via patient-controlled analgesia (PCA) with limited exceptions established by Mercy’s Quality Council.

Procedure:
Refer to Lippincott procedure:  *Patient-controlled analgesia (PCA) and Capnography (EtCO2)* http://procedures.lww.com/lnp/view.do?plId=94871

A. Patient Controlled Analgesia:  
1. For patient safety, orders entered without using the approved PCA Order set are defaulted to the approved, electronic PCA Order set.  
2. Regulatory requirements no longer accept “Range Orders.”  
3. Patients receiving Patient Controlled Analgesia (PCA) wear a continuous capnography monitoring device throughout the PCA treatment period except when  
   a. there are allowable, temporary interruptions of capnography: eating; mouth
care; facial cleansing/shaving (See section B2)

b. an alternative continuous EtCO2 monitoring / alarm system is in place

c. patient is mechanically ventilated

d. End-of-life care is initiated with a provider’s order

e. Palliative care patient has Palliative Care physician’s orders deferring EtCO2 monitoring

4. Capnography monitoring is worn by patients on PCA’s with CPAP, non-invasive ventilation (NIV), and tracheotomy/laryngectomy. Notify appropriate department (Respiratory Therapy or Cardiopulmonary) if any of the following is ordered:

a. Patient is on CPAP
b. Patient is on NIV (non-invasive ventilation)
c. Patient has a tracheotomy/laryngectomy (side stream sample line is available)

5. Capnography is worn when leaving nursing unit for testing, dialysis, surgery, etc.

6. When testing cannot be completed on the unit, patients on PCA/capnography cannot be left unattended in testing areas. If transported to a testing area the patient must be supervised by a coworker knowledgeable about how to notify a promptly available PCA/Capnography trained RN to assess the patient.

7. Delegation: Delegation is to be in keeping with nurse practice acts and state administrative code

a. RN may perform
   1. opioid syringe setup
   2. dose programming on the pump
   3. any changes in the program
   4. wastage of medication in Omnicell by two licensed nurses
   5. setup Capnography device and evaluation of Capnography data (per facility practice)

b. Per Facility policy responsible department, such as Respiratory Therapy or Cardiopulmonary Department coworker, may perform:
   1. set up Capnography device and evaluation of Capnography data (per facility practice)
   2. assess patient respiratory status

c. IV Certified LPN’s may:
   1. Administer premixed pain medication via PCA pump, which includes assembling and programming of the pump.
   2. Assemble, program and administer continuous or intermittent parenteral fluid infusions via electronic infusion pumps.
   3. Obtain and report “data” such as vital signs, patient/family comments, patient stated pain rating.

d. LPNs, PCAs/PCT/Med Assistants – may not assess. They may collect data and report/document patient/family comments such as a pain number. They are not assessing and assigning a pain number but reporting the patient’s stated pain #.

B. Capnography monitoring:

1. Patients receiving Patient Controlled Analgesia (PCA) wear a continuous capnography monitoring device throughout the PCA treatment period except when:
a. an alternative continuous EtCO2 monitoring / alarm system is in place
b. patient is mechanically ventilated
c. End-of-life care is initiated with a provider’s order
d. Palliative care patient with Palliative Care physician’s orders deferring EtCO2 monitoring

2. The allowable, temporary interruptions of capnography specifically are: eating; mouth care; facial cleansing/shaving.

3. Continue capnography monitoring for 2 hours after PCA is discontinued or longer per nursing judgment or provider order.

4. Capnography is worn when leaving nursing unit for testing, dialysis, surgery, etc.

5. When testing cannot be completed on the unit, patients on PCA/capnography cannot be left unattended in testing areas. If transported to a testing area the patient must be supervised by a coworker knowledgeable about how to notify a promptly available PCA/Capnography trained RN to assess the patient.

   • An alternative pain management therapy will be ordered.

7. EtCO2 monitoring is worn by patients on PCA’s with CPAP, non-invasive ventilation (NIV), and tracheotomy/laryngectomy. Notify appropriate department (Respiratory Therapy or Cardiopulmonary) if any of the following is ordered:
   a. patient is on CPAP
   b. patient is on NIV (non-invasive ventilation)
   c. patient has a tracheotomy/laryngectomy (side stream sample line is available)

C. Assessment and Documentation:
   1. Patients are assessed a minimum of every 2 hours or more frequently per nursing judgment or provider order and data is entered into the health record.

   2. Physical Assessment includes, but not limited to:
      Sedation scale – *Pasero Opioid-Induced Sedation Scale (POSS)*
      
      S = sleep, easy to arouse
      Acceptable
      1 = awake and alert
      Acceptable
      2 = slightly drowsy, easily aroused
      Acceptable
      3 = frequently drowsy, arousable, drifts off to sleep during conversation
      Unacceptable; monitor respiratory status and sedation level closely until sedation level is stable at <3 and respiratory status is satisfactory.
      Notify prescriber or anesthesiologist for orders.
      4 = somnolent, minimal or no response to verbal and physical stimulation
      Unacceptable; stop opioid; consider administering naloxone; call Rapid Response Team and/or Code Blue; stay with patient, stimulate, and support respiration as indicated by patient status; notify primary‡ or anesthesia provider; monitor respiratory status and sedation level closely until sedation level is stable at <3 and respiratory status is satisfactory.

5. **Credentialed provider evaluation prior to ordering:** (JC-SEA-Opioids 2012).
   a. The provider evaluates the patient for risk of over sedation and respiratory depression. Patient specific risk factors may include:
      - Pre-existing *pulmonary / cardiac disease* or dysfunction such as COPD and Heart Failure or major organ failure (renal or hepatic impairment)
      - Known or suspected sleep-disordered breathing problems (i.e. sleep apnea, sleep disorder diagnosis).
      - Morbid obesity with high risk of sleep apnea
      - Snoring
      - Older age
      - No recent opioid use
      - Post-surgery, particularly if upper abdominal or thoracic surgery. Longer length of time receiving general anesthesia during surgery.
      - Smoker
   b. Non-patient factors include co-administration of:
      - Benzodiazepine
      - Antihistamines
      - Sedatives
      - Central nervous system depressants

**DEFINITIONS**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Patient Controlled Analgesia (PCA):</td>
<td>A drug delivery system providing IV analgesia, when the patient presses a button at the end of a cord. Analgesia is provided at the level and time needed by the patient. The device prevents the patient from accidentally overdosing by imposing a lockout time between doses. During this interval, the patient won't receive any analgesic, even if he pushes the button.</td>
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<tr>
<td>Clinician Bolus Dose</td>
<td>A dose of medication programmed and activated by the nurse via the PCA module during an active PCA infusion.</td>
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<tr>
<td>Continuous Infusion Only</td>
<td>The PCA module delivers a preset continuous rate, but does not allow the patient to deliver a PCA dose, may also be referred to as “basal rate”.</td>
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<tr>
<td>Loading Dose</td>
<td>A dose of medication programmed and activated by the nurse via PCA module prior to initiation of PCA infusion.</td>
</tr>
<tr>
<td>PCA Dose and Continuous Infusion</td>
<td>The PCA module delivers a preset continuous rate and also permits the patient to receive a patient controlled dose.</td>
</tr>
<tr>
<td><strong>Total Demands</strong></td>
<td>Or PCA Attempts. Total number of times the patient pressed the dose button on the PCA module for the infusion period.</td>
</tr>
<tr>
<td><strong>Total Delivered</strong></td>
<td>Total number of times patient received a dose after patient pressed the dose button for the infusion period.</td>
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<tr>
<td><strong>Guardrails® clinical advisory</strong></td>
<td>A user message that appears on the “Main Display” when a designated drug is selected to remind the nurse of specific hospital standards of practice.</td>
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<tr>
<td><strong>Guardrails® limit</strong></td>
<td>Built-in programmed safety parameters of medication dosing for drugs in each profile used in the PCA module. Minimum and maximum dosing ranges considered safe for patient administration have been pre-programmed</td>
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<tr>
<td><strong>End-tidal carbon dioxide (ETCO2)</strong></td>
<td>Capnography or end-tidal (exhaled) carbon dioxide (CO2) monitoring provides a non-invasive, continuous measurement of respiratory rate and exhaled CO2 concentration over time, measured at peak of expiration.</td>
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<tr>
<td><strong>Pulse Oximetry (SpO2)</strong></td>
<td>Non-invasive monitoring of functional oxygen saturation or arterial hemoglobin (SpO2) and pulse rate.</td>
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<td><strong>Caregiver Controlled Analgesia (CCA)</strong></td>
<td>The authorized agent is a non-professional individual (e.g. parent, significant other) also known as PCA by Proxy.</td>
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<td><strong>Authorized Users</strong></td>
<td>Respiratory Therapists and Licensed Nurses will be the co-workers that initiate and monitor the EtCO2 equipment and patient. Employing a team approach, the patient will be set up using a capnography sample line when placed on a PCA infusion device programmed to administer either opioids or sedatives.</td>
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### PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</table>
| End-tidal carbon dioxide (ETCO2) | Normal Value: 30-45 mmHg  
Note, ETCO2 under normal conditions can be 2-5 mmHg lower than an arterial PaCO2 on an arterial blood gas sample. Normal PaCO2 from an ABG sample is 35-45 mmHg. |
| Fractional inspired carbon dioxide (FiCO2) | Normal Value: 0 mmHg  
This is the "0" baseline on the capnogram. |
Adult Respiratory Rate  
Normal Value: 10-24 breaths per minute

<table>
<thead>
<tr>
<th>Alaris Alarm Defaults</th>
<th>Alarm Setting</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETCO2 (mmHg)</td>
<td>10</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Adult Respiratory Rate</td>
<td>6</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Adult PCA Pause for Low RR</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FiCO2 (mmHg)</td>
<td>-</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>No Breath (Apnea) Adult</td>
<td>-</td>
<td>30 seconds</td>
<td></td>
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References

Centers for Medicare and Medicaid, DRAFT. Appropriate monitoring of patients receiving an opioid via an IV patient controlled analgesia device. 2013


