Use of Capnography to Detect Early Respiratory Depression in Non-intubated Patients on Opioids and Benzodiazepine

Baby Lyn Corpuz Abadilla, MBA, MSN, RN
2 West (Intensive Care Unit)
1501 Trousdale Drive Burlingame, CA, 94010 USA

AIM
• Provide early detection of respiratory depression among high risk non-intubated patients on opioids and benzodiazepines through the use of capnography.

PICO Question
• Does the use of capnography among high risk non-intubated patients on opioids and benzodiazepines (BZD) provide early detection of respiratory depression?

Background
• Respiratory depression is a widely recognized possible complication of sedation and analgesic administration.
• Balancing the need of giving opioids and benzodiazepines against their adverse effects can be a big challenge to Intensive Care Unit (ICU) bedside nursing.
• Adverse effects include high risk for hypoventilation leading to respiratory depression, cardiopulmonary arrest, anoxic brain injury (confusion/drowsiness), and death.
• The situation, if not properly monitored, can be costly with increased ICU length of stay and lead to unnecessary nursing and medical interventions such as arterial puncture(s) for arterial blood gas analysis and insertion of endotracheal tube for airway management.
• Intermittent monitoring of patients on opioids and benzodiazepine can miss signs of respiratory depression.
• Pulse oximetry is the only method that is currently used to monitor oxygen saturation.
  - Limitations:
    - Only monitors the oxygenation saturation of arterial hemoglobin.
    - Unable to monitor the real time ventilation status of the patient.
    - Pulse oximetry with supplemental oxygen can mask hypoventilation. (Figure 1a)

What is Capnography?
Capnography – a tool that can assess ventilatory status.
• Non-invasive real time measurement.
• Presented as a graph of expiratory carbon dioxide or otherwise called as end tidal carbon dioxide (EtCO₂) or Partial end tidal carbon dioxide (PetCO₂). (Figure 1a)
• Normal Value: between 30-40 mmHg.
  - (2-5 mmHg lower than partial pressure of arterial CO₂ (PaCO₂).
• Detects early changes in the respiration and patient’s ventilator cycle. (Figure 1a)
• Enables immediate corrective action to mitigate respiratory depression.

Methods
• Based on the literature, a mnemonic and algorithm were developed to efficiently identify, assess, manage, and evaluate high risk patients. (Figure 3 and 4)
• High risk patients for respiratory depression who were on opioids and benzodiazepines were identified using a mnemonic, “PASSPORT.” (Figure 3)
• The algorithm was implemented to monitor patients and suggested nursing actions.
• Data was collected and reviewed.

Results
• 16 high risk non-intubated patients were chosen using the mnemonic, “PASSPORT.” (Figure 3)
• Final data completed on 12 patients. (Eliminated 4 due to incomplete data)
• Capnography and pulse oximetry applied to patients who were given doses of opioids and benzodiazepines.
• Algorithm was used to monitor patients. (Figure 4)
• Patterns of improved EtCO₂/PetCO₂ were observed after 2-3 hours stay in ICU. (See figures 5 and 6)
• The use of pulse oximetry masks hypoventilation. (See figures 5 and 6)
• 1 Patient became fully awake and oriented after 6 hours. (See figure 5)
• Decrease length of ICU stay. (See figure 5)
• Capnography assessment helped prevent intubating high risk patients in ICU.
  - 4 Patients on BIPAP did not require intubation. (Figure 7)

Conclusions
• The algorithm developed served as a valuable tool and guide to the bedside nurse in detecting and managing early respiratory depression in high risk non-intubated patients on opioids and benzodiazepines.
• The use of capnography together with pulse oximetry helps in identifying early changes in the respiratory status of the patient receiving opioids and benzodiazepines thus, increases patient safety, patient satisfaction and reduction of cost by decreasing ICU length of stay.
• Changes in EtCO₂ act as an early warning sign for potential complications allowing the bedside nurse to immediately assess and intervene immediately to improve patient outcome.
• Sharing the results of the project with staff and doctors:
  - Create a wider unit-based project:
    - education module - proper use of equipment - monitoring of patient