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GROWING WAVE OF CAPNOGRAPHY
Improving outcomes. It’s your goal with every patient you care for. But one of the greatest threats can also be one of the most difficult to detect. Respiratory compromise — incidents of respiratory insufficiency, failure, and arrest — can strike subtly and suddenly.

There is a growing wave of clinical societies recommending continuous capnography monitoring, along with pulse oximetry, to alert you to changes in oxygenation and ventilation — two key factors in identifying respiratory compromise in its early stages.

KEY RECOMMENDATIONS

While society guidelines and recommendations vary by application and area of care, most support using waveform capnography under specific situations, such as:

- During administration of opioids for pain management
- With patients receiving supplemental oxygen
- With patients under moderate to deep sedation
- When transporting mechanically ventilated patients
- During CPR
- To ensure the proper placement of endotracheal tubes

TOUR THIS EBOOK TO:

- Read about some of the clinical societies publishing guidelines and standards for capnography monitoring
- View guideline and recommendation summaries
- Gain insight on specific recommendations

1. http://www.apsf.org/about.php
These profiles represent only some of the clinical societies recommending the use of capnography monitoring to help improve patient care and safety.
AARC
The American Association for Respiratory Care (AARC) works to advance the science and practice of respiratory care by fostering and promoting professional excellence for respiratory care professionals and advocating for patients and their families.¹

AHA
The American Heart Association (AHA) is a voluntary organization dedicated to building healthier lives by fighting heart disease and stroke. The AHA funds research, advocates for public health policies, and offers resources to help save and improve lives.²

ASA
The American Society of Anesthesiologists (ASA) is a professional organization of anesthesiologists dedicated to raising and maintaining the standards of the medical practice of anesthesia and improving patient care. The society provides continuing education to its members and advocates for state and federal guidelines to improve patient safety and outcomes.³

APSF
The Anesthesia Patient Safety Foundation (APSF) strives to improve patient safety during anesthesia care by encouraging national and international collaboration safety research and education, and patient safety initiatives.⁴

ARIN
The Association for Radiologic and Imaging Nursing (ARIN) provides radiology nurses with the knowledge and resources to advance the standards of care for patients undergoing radiology procedures. Procedures include diagnostic, neuro, cardiovascular, interventional, ultrasonography, computerized tomography, nuclear medicine, magnetic resonance, or radiation oncology.⁵

ESA
The European Society of Anaesthesiology (ESA) works to improve the safety standards for the administration of anesthesia. The Society promotes education, research, and the exchange of information about anesthesia and pain management to improve patient outcomes, particularly the reduction of morbidity.⁶

JC
The mission of the Joint Commission (JC) is to evaluate health care organizations and inspire them to continuously improve healthcare with safe, effective, high-quality care. The Joint Commission accredits and certifies nearly 21,000 healthcare organizations in the United States, reflecting their commitment to quality and performance standards.⁷

SGNA
The Society of Gastroenterology Nurses and Associates, Inc. (SGNA) is committed to the safety and effectiveness of gastroenterology and endoscopy nursing by supporting professional development, education, research, advocacy and collaboration.⁸

SIR
The Society of Interventional Radiology is an organization of practicing interventional radiologists, scientists, and other health professionals dedicated to delivering patient care with minimally invasive, image-guided therapy.⁹

¹ http://www.aarc.org/aarc/us/
² http://www.heart.org/HEARTORG/General/About-Us---American-Heart-Association_UCM_305422_SubHomePage.jsp.
³ http://www.asahq.org/about-asa
⁴ http://www.apsf.org/about.php
⁵ http://www.esahq.org
⁶ http://www.arinursing.org/about-arin/
⁷ https://www.jointcommission.org/about_us/fact_sheets.aspx
⁸ http://www.sgna.org/About-Us/Mission-Statement
⁹ http://www.sirweb.org/about-us/
In 2011, the AARC issued clinical practice guidelines for the use of capnography by analyzing the results of more than 200 clinical trials, a review of 19 articles on capnography monitoring during mechanical ventilation, and the consideration of the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. The guidelines recommend capnography/capnometry to:

- Verify the correct placement of endotracheal tubes and artificial airways
- Assist in the assessment of pulmonary circulation and respiratory status
- Optimize mechanical ventilation

The AHA issued Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care in 2010 calling for capnography monitoring to help clinicians monitor quality of chest compressions, to confirm endotracheal tube placement and to utilize as an early indicator of the return of spontaneous circulation (ROSC). In 2015, the AHA updated its guidelines to include additional clinical utility for capnography that builds on the 2010 recommendations. One of the major updates includes using capnography monitoring as a potential indicator to help guide end-of-life resuscitative efforts in adults and to assess CPR quality in pediatric patients to help avoid risk of exposure to hypocapnia or hypercapnia.

As a part of the Standards for Basic Anesthetic Monitoring, the ASA recommends that clinicians should monitor oxygenation, ventilation, circulation, and temperature continuously during administration of all anesthetics. For patients under moderate to deep sedation, the society advocates the use of both pulse oximetry and capnography along with visual monitoring. The ASA Standards also state that end tidal CO₂ monitoring is required when an endotracheal tube or laryngeal mask is in place.

The APSF recognizes that drug-induced respiratory depression in the postoperative period is a patient safety risk in some patients and can result in significant morbidity and mortality. The APSF highlights that while structured assessments of the patient’s level of consciousness and frequent spot checks are critical, they may not offer an indication of respiratory depression as quickly as continuous electronic monitoring of oxygenation and ventilation.

To help reduce the likelihood of unrecognized, clinically significant opioid-induced respiratory depression, the APSF recommends continuous monitoring of oxygenation and ventilation.

The ARIN Position Statement endorses the routine use of capnography for all patients who receive moderate sedation or analgesia during procedures in the imaging environment. Use of capnography monitoring will help clinicians detect respiratory depression, hypventilation, and apnea, as capnography use is associated with improved patient outcomes. Capnography should be used at all times regardless of whether sedation is administered by an anesthesia provider or a registered nurse credentialed to administer moderate sedation.

ESA\textsuperscript{7}

The ESA recommends that capnography be used with all patients undergoing procedural sedation so that ventilation problems can be detected quickly. Continuous evaluation of ventilation and levels of carbon dioxide during sedation can be achieved through capnography.

Pulse oximetry measures oxygenation but does not provide measurements for ventilation if supplemental oxygen is given to the patient, and therefore, additional monitoring should also be used to monitor appropriate respiratory function.

The use of capnography has been shown to help reduce incidents of apnea and hypoxia in patients undergoing sedation and intubation. Capnography results in earlier detection of hypoxia in patients experiencing sedation with propofol. Additional methods of measuring carbon dioxide levels improve the effectivity of capnography.

Joint Commission\textsuperscript{8}

The Joint Commission Sentinel Event Alert #49 outlines a number of steps that can be implemented to help hospitals better manage unintended consequences of opioid-induced respiratory depression. One of the recommendations includes developing and implementing protocols and policies for continuous patient monitoring for patients receiving opioid analgesia during the administration of opioids.

Specifically, The Joint Commission advises the use of both pulse oximetry and waveform capnography because pulse oximetry alone may indicate adequate oxygenation when the patient’s ventilation is compromised. The recommendations emphasize the use of ventilation monitoring when a patient has higher risk of respiratory depression and supplemental oxygen is in use.

In 2018, The Joint Commission identified safe opioid prescribing for pain management as an organizational priority for hospitals. Additionally, The Joint Commission specifies that hospital leadership and clinicians identify and acquire patient monitoring technology for use with patients at high risk for adverse events as a result of treatment with prescribed opioids.\textsuperscript{9}

SGNA\textsuperscript{10}

The SGNA cites drug-induced respiratory depression as the primary cause of morbidity during procedural sedation. To help reduce these incidents, the SGNA recommends standard monitoring (inclusive of oxygenation saturation, heart rate, respiratory frequency and ventilation, blood pressure), along with physiological, hemodynamic, pulmonary ventilation, oxygenation and capnography monitoring.

SIR\textsuperscript{11}

SIR recognizes that ASA standards are the basis for anesthesia administration credentials in most medical facilities. As a result, the SIR position statement concludes that interventional radiology professionals should become familiar with the changes to the standards set by the ASA, as any significant change in the ASA standards for moderate and deep sedation will have a downstream impact on most interventional radiology practices.\textsuperscript{9}

In addition, SIR also notes the American Heart Association (AHA) guidelines for the use of capnography for endotracheal tube assessment, cardiac and respiratory arrest care and cardiopulmonary resuscitation.\textsuperscript{10,11}


\textsuperscript{8} The Joint Commission Sentinel Event Alert. Safe use of opioids in hospitals Issue 49, August 8, 2012.


\textsuperscript{10} http://www.sgna.org/GI-Nurse-Sedation/Patient-Care-Safety

COMPLIANCE WITH SOCIETY RECOMMENDATIONS FOR CAPNOGRAPHY MONITORING
MONITORING COMPLIANCE WITH APSF RECOMMENDATIONS

- Use capnography monitoring with all patients receiving opioids for post-operative pain management, including patients without risk factors for respiratory complications.
- To help reduce the likelihood of unrecognized, clinically significant opioid-induced respiratory depression, the APSF recommends continuous monitoring of oxygenation and ventilation.

MONITORING COMPLIANCE WITH JOINT COMMISSION RECOMMENDATION FOR SAFE USE OF OPIOIDS

- Use capnography monitoring with all patients receiving opioids for post-operative pain management, including patients without risk factors for respiratory complications.
- Develop and implement protocols for continuous monitoring of patients receiving opioid therapy with individualized assessments to measure the quality and adequacy of respiration and depth of sedation.
- Identified safe opioid prescribing for pain management as an organizational priority.
- Hospital leadership and clinicians should work together to identify and acquire patient monitoring technology for use with patients at high risk for adverse events as a result of treatment with prescribed opioids.

PROCEDURAL SEDATION

ASA, ARIN, ESA, SGNA and SIR all advocate for capnography during moderate to deep procedural sedation for improved patient outcomes.1-5

MONITORING COMPLIANCE WITH ASA STANDARDS1
- For patients under moderate to deep sedation, the society advocates the continuous use of both pulse oximetry and capnography along with visual monitoring.

MONITORING COMPLIANCE WITH ARIN POSITION STATEMENT2
- All radiologic and imaging nursing professionals should be familiar with the use of capnography and the information it provides as an objective evaluation of a patient’s ventilatory status.
- Capnography should be used for all patients who receive sedation while undergoing imaging procedures.

MONITORING COMPLIANCE WITH SGNA GUIDELINES FOR PATIENT MONITORING3
- Personnel should be familiar with levels of sedation and have the skills to intervene if the sedation becomes deeper than planned or the patient suffers an adverse reaction.
- Equipment should be on hand to monitor vital signs, including oxygen saturation (pulse oximetry) and respiratory ventilation (waveform capnography).

MONITORING COMPLIANCE WITH SIR POSITION STATEMENT4
- Interventional radiologists using moderate sedation should understand the potential benefits of using capnography in addition to pulse oximetry monitoring, and become familiar with ASA and AHA guidelines.
- Obtain capnography monitoring equipment and incorporate it into clinical practice.

MONITORING COMPLIANCE WITH ESA POSITION STATEMENT5
- Pulse oximetry is essential for bedside monitoring.
- Capnography is required for all patients receiving procedural sedation.

CPR

MONITORING COMPLIANCE WITH 2011 AARC CLINICAL PRACTICE GUIDELINES

- Optimize chest compressions and detect ROSC during chest compressions or when rhythm check reveals organized rhythm.

MONITORING COMPLIANCE WITH AHA GUIDELINES

- Improve chest compression performance if etCO₂ is < 10mm Hg.
- Perform CPR at a rate of 10 breaths per minute with minimal chest rise.
- As an indication of return of spontaneous circulation.

AARC and AHA recommend the use of capnography monitoring during cardiopulmonary resuscitation.

MONITORING COMPLIANCE WITH 2011 AARC CLINICAL PRACTICE GUIDELINES¹

- For patients under moderate to deep sedation, the society advocates the continuous use of both pulse oximetry and capnography along with visual monitoring.

MONITORING COMPLIANCE WITH JOINT COMMISSION RECOMMENDATION—SENTINEL EVENT ALERT #49²

- Because drug levels may reach peak concentrations during discharge and transport, take extra precautions during these activities.

INTUBATION

AARC, AHA, and ASA recommend the use of capnography monitoring for intubated patients.1-3

MONITORING COMPLIANCE WITH 2011 AARC CLINICAL PRACTICE GUIDELINES1

■ Confirm correct placement of endotracheal tubes.
■ Guide ventilator management.
■ Monitor mechanically ventilated patients during transport.
■ Monitor intubated patients for cardiopulmonary quality.

MONITORING COMPLIANCE WITH AHA GUIDELINES2

■ Use capnography monitoring to confirm placement of endotracheal tubes.

MONITORING COMPLIANCE WITH ASA STANDARDS3

■ End tidal CO₂ monitoring is required when an endotracheal tube or laryngeal mask is in place.

MONITORING COMPLIANCE WITH APSF RECOMMENDATIONS

- When supplemental oxygen is prescribed, capnography or other monitoring modalities is indicated to measure adequacy of ventilation.

MONITORING COMPLIANCE WITH JOINT COMMISSION—SENTEINEL EVENT #49

- Use ventilation monitoring when a patient has higher risk of respiratory depression and supplemental oxygen is in use.


SOCIETIES WORLDWIDE RECOMMENDING THE USE OF CAPNOGRAPHY
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<tr>
<th>Acronym</th>
<th>Full Name</th>
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<td>Accreditation Association for Ambulatory Health Care Institute for Quality Improvement (US)</td>
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