

CAPNOGRAPHY IN INTERVENTIONAL RADIOLOGY

Providing Safe Sedation

Moderate to deep procedural sedation is frequently used in interventional radiology (IR) to facilitate the successful performance of a diagnostic or therapeutic procedure while ensuring patient comfort and cooperation by controlling pain and relieving anxiety.¹ The IR environment can be highly complex, involving older and sicker patient populations with multiple comorbidities. In addition, the ability to directly observe the patient's ventilation and remain in constant patient communication is often challenged (e.g., separation of clinician from patient, MRI, dark environment, draping of patient, patient positioning).²

During moderate sedation, spontaneous ventilation and a patent airway are generally well preserved. However, patients may drift into deeper levels of sedation during which spontaneous ventilation may be inadequate and intervention may be required to maintain the airway. It is not always possible to predict how individual patients will respond to the sedation medications used; clinicians must be able to rescue patients whose level of sedation becomes deeper than initially intended.³ Even when events are not severe, they often cause disruptions in workflow (e.g., increasing oxygen, reversal agents), which can result in added costs from preventable delays during the procedure.⁴

In a review of the American Society of Anesthesiologists (ASA) closed-claims database (i.e., cases which resulted in malpractice suits) for anesthesia outside the operating room, 62% of claims due to oversedation were assessed to be "preventable by better monitoring."⁵ In a similar review of the ASA database for monitored anesthesia care (MAC), researchers state that respiratory depression, after absolute or relative overdose of sedative or opioid drugs, was the most common specific damaging mechanism in MAC claims. Of these claims, nearly half were judged as preventable by better monitoring, including capnography.⁶

In 2011, the ASA released an update to Standards for Basic Anesthetic Monitoring, stating that during moderate or deep sedation, the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment.⁷

INTERVENTIONAL RADIOLOGY SOCIETAL SUPPORT

In 2015, the Society of Interventional Radiology reiterated the ASA standard in their own practice parameter: during moderate or deep sedation, the adequacy of ventilation should be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment.⁸

In 2016, the Association for Radiologic & Imaging Nursing (ARIN) released a position statement endorsing the routine use of capnography for all patients who receive moderate sedation/analgesia during procedures in the imaging environment.⁹

- Capnography provides important information to help clinicians detect respiratory compromise during sedation (e.g., respiratory depression, hypoventilation, and apnea), permitting early intervention
- Capnography may help improve patient outcomes and is associated with cost-avoidance secondary to decreases in adverse events
- Capnography should be used for all moderate and deep sedation, whether administered by a trained anesthesia professional or by a qualified registered nurse who provides sedation under the direction of an interventional radiologist

Along with the ARIN position statement, additional resources have been made available by the ARIN task force.

- [Capnography monitoring during procedural sedation in radiology and imaging settings: An integrative review](#)²: Provides a thorough literature review summarizing the findings which led to the position statement. The unanimous opinion of the task force concludes that adoption of capnography as a routine monitor is advised, particularly because of the visual loss of ventilator cues often experienced in radiology and imaging departments.
- [Capnography for the radiology and imaging nurse: A primer](#)¹⁰: Provides concepts for capnography monitoring, practical uses, physiology overview, and a standardized method for analysis. In addition to use of capnography while monitoring sedation, this primer provides an overview of the key role of capnography during advanced cardiovascular life support (ACLS) and pediatric advanced life support (PALS), as recommended by the American Heart Association, should resuscitation become necessary in the IR suite.¹¹

SUMMARY

Procedural sedation used in the IR suite may result in respiratory compromise, including respiratory depression, hypoventilation, bradypnea, apneas, and airway complications, which when not properly recognized may result in catastrophic outcomes including deaths.^{5,6} Capnography provides IR clinicians with a powerful tool to recognize evolving respiratory compromise early, allowing intervention to prevent serious respiratory events.

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