



Statement

Universal adoption of capnography for moderate sedation in adults undergoing upper endoscopy and colonoscopy has not been shown to improve patient safety or clinical outcomes and significantly increases costs for moderate sedation.

Capnography is a method of physiologic monitoring that takes advantage of carbon dioxide properties of absorption in the near-infrared region of the electromagnetic spectrum. This allows for a near continuous assessment of the carbon dioxide level throughout the respiratory cycle as well as a near real-time graphic assessment of respiratory activity. The American Society of Anesthesiologists' Standards for Basic Anesthetic Monitoring was revised to further expand the role of capnography for procedural sedation and became effective July 1, 2011.⁽¹⁾ In section 3.2.4, this document recommends capnography monitoring to include moderate sedation commonly used for endoscopic procedures. It states, *"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."* This supplants the ASA's 2002 standard which states, *"During regional anesthesia in monitored anesthesia care the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and/or monitoring for the presence exhaled carbon dioxide."*⁽²⁾

Because the ASA guidelines are often used as a basis for regulatory guidelines applied in both the hospital and ambulatory setting, the addition of a requirement for capnography creates a significant change in the landscape of procedural sedation practice. The basis for this change should rest on evidence supporting the clinical value of capnography monitoring.

What is the level of evidence that supports this recommended change in sedation practice? Currently there are no data that supports the ASA's recommendation for use of capnography during endoscopic procedures in adults where moderate sedation is targeted. All of the reported data for the use of capnography during gastrointestinal endoscopy resides either in the pediatric endoscopic literature or derives from studies involving patients undergoing advanced endoscopy procedures where deep sedation was targeted. In support of their 2011 statement the ASA references the randomized controlled trial by Lightdale et al in a pediatric population undergoing targeted moderate sedation for elective upper endoscopy and colonoscopy with the combination of an opioid and

benzodiazepine. No adverse events related to hypoxemia were reported in this trial, though it was insufficiently powered for this endpoint.⁽³⁾

The ASA also cites the literature on the use of capnography in adults undergoing endoscopy for advanced upper endoscopic procedures (ERCP/EUS) where deep sedation was targeted. In a series of 49 patients undergoing extended therapeutic endoscopic procedures with meperidine and midazolam, capnography was found to be a reliable indicator of respiratory rate when compared with the reference standard pretracheal stethoscope.⁽⁴⁾ Fifty-four episodes of apnea or disordered respiration were noted in 28 of these patients. Only 50% of these episodes were detected eventually by pulse oximetry and none were noted by visual assessment. Notably, the authors could not produce validated definitions for apnea or disordered respiration in the anesthesia literature. They developed definitions for these cardiopulmonary outcomes via expert opinion. Similarly, in another randomized control study targeting deep sedation, these investigators demonstrated that capnography reduced the incidence of hypoxemia and apnea in patients undergoing endoscopic retrograde cholangiopancreatography and endoscopic ultrasonography.⁽⁵⁾ These findings cannot be extrapolated or applied to moderate sedation for routine endoscopy.

There are no studies that have investigated the use of capnography during moderate sedation for routine gastrointestinal endoscopy in adults. Therefore, there is no support for the ASA's insistence on the universal use and added cost of capnography for moderate sedation. In 2009 the Multi-Society Task Force on the Nonanesthesiologist Administration of Propofol for GI Endoscopy concluded that the level of evidence for the use of capnography for upper endoscopy and colonoscopy was insufficient to prove its benefit.⁽⁶⁾ For ERCP and the EUS the level evidence was slightly stronger as only two randomized controlled trials have been published.^(5,7) Despite this paucity of supporting evidence demonstrating the benefit of capnography the ASA has endorsed its routine use.

Capnography devices often indicate problems where none exist. These "false alarms" may lead to unnecessary procedure interruption, delay, or termination contributing to inefficiency and additional procedures or costs. At worst, frequent alarm errors may lead to alarm fatigue and a tendency to ignore valid alarms. Additionally the predictive value of various capnographic outcomes for significant adverse events is unknown. Sedation in routine GI endoscopy is extraordinarily safe. Sedation-related mortality in gastrointestinal endoscopy occurs in approximately 8/100,000 cases for endoscopist-directed opioid/benzodiazepine sedation and 0.6/100,000 cases for endoscopist-directed propofol sedation.⁽⁸⁾ Capnography has never been shown to improve the extremely infrequent occurrence of sedation related complications.

The ASA's revised recommendations also fail to standardize definitions of apneic events and the appropriate interventions for various respiratory events during sedation. A universally accepted nomenclature for airway compromise, problem definitions and the development / validation of a set of capnography outcomes that are predictive of cardiopulmonary events is clearly an important prerequisite prior to implementing a policy change related to sedation monitoring. For example, pseudoapnea is common

when a patient is orally intubated such as during esophagogastroduodenoscopy (EGD). While the ability to discern artifact from true physiologic events is crucial to the interpretation of capnography, these events have not been defined.

Summary

There are insufficient data to demonstrate that improved clinical outcomes or care quality derive from the use of capnography in adults undergoing targeted moderate sedation for upper endoscopy and colonoscopy. The adoption of the revised ASA Standard will unnecessarily add cost, inefficiency and waste to a healthcare system already overrun with excess costs and waste. Furthermore, the absence of standardized and validated definitions and recommended responses to capnography findings further discourages the application of a costly technology that has no proven value in healthcare delivery.

The American Society for Gastrointestinal Endoscopy, the American Gastroenterological Association and the American College of Gastroenterology strongly support collaboration with the ASA to develop and validate a lexicon for capnography to include definitions, recommended interventions, and further clinical studies to provide an evidence-based standard which will lead to improved patient care.

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