



Association for Radiologic & Imaging Nursing
POSITION STATEMENT
Capnography

Introduction

The administration of moderate sedation/analgesia for diagnostic and interventional radiological procedures remains a critical component of the radiologic and imaging nurses' scope of practice. Sedation is a continuum with complexities requiring hyper-vigilant monitoring of multiple physiologic parameters. Early detection of patient progression towards a deeper level of sedation is paramount in preventing a sentinel event. Radiologic and imaging nurses need the appropriate skill sets and require the technology to effectively monitor those patient health parameters. These monitoring parameters include level of consciousness, respiratory status with oximetry, heart rate with ECG and non-invasive blood pressure.

Minimally invasive procedures performed in imaging departments have increased in complexity. The increase in complexity is due to the evolution of operating room hybridization compounded by an aging population with multiple comorbidities. Accordingly, radiologic and imaging nurses are challenged to leverage the available technology to improve intra-procedural safety and patient outcomes within this higher risk population.

In 2010, the American Society of Anesthesiologists (ASA) amended their position statement on moderate sedation by non-anesthesiologists to require evaluation of ventilation by end tidal CO₂ monitoring.(ASA, 2015) This new standard by the ASA has not been without controversy and thus has resulted in slow adoption across many modalities and specialties.

In response to the requirement posed by the ASA and to enhance patient safety, the Association for Radiologic & Imaging Nursing (ARIN) appointed a taskforce to address these concerns by synthesizing and disseminating the most current evidence available with the purpose of providing its members with an evidence based position statement to guide practice.

Position

ARIN endorses the routine use of capnography for all patients who receive moderate sedation/analgesia during procedures in the imaging environment. This technology provides the critical information necessary to detect respiratory depression, hypoventilation, and apnea, thus allowing the timely initiation of appropriate interventions to rescue the individual patient. 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/analgesia medications.

Rationale

Radiologic and imaging nurses administering moderate sedation/analgesia are expected to understand the difference between oxygenation and ventilation but may not always appreciate the additional diagnostic benefits that capnography monitoring offers. Capnography is a measurement of the concentration of exhaled carbon dioxide (EtCO₂). The monitor displays a numerical value and a waveform. As such, it is an objective evaluation of the patient's ventilatory status.

Since 1999, the American Society of Anesthesiologists (ASA) utilizes capnography as a standard monitoring tool for those patients undergoing general anesthesia except when extenuating circumstances require an exception.(ASA, 2015) The task force concluded that the evidence has shown a clear superiority of capnography in evaluation of patient's ventilatory status when compared with current routine monitoring practices resulting in safer patient care. Key concepts found in the literature:

- Access to capnography ensured timely provider interventions in response to hypoventilation and resulted in fewer hypoventilatory episodes with a decrease in hypoxic events.(Beitz et al., 2012; Langhan, Shabanova, Li, Bernstein, & Shapiro, 2015; Slagelse, Vilmann, Hornslet, Jorgensen, & Horsted, 2013; van Loon, van Rheineck Leyssius, van Zaane, Denteneer, & Kalkman, 2014)
- Respiratory depression is identified sooner when compared to pulse oximetry monitoring (Adams, Butas, & Spurlock, 2015; Cacho et al., 2010). One study noted an average detection time of respiratory depression 3.7 minutes sooner; another demonstrated that capnography use was 17.6 times more likely to detect respiratory depression compared with standard monitoring.(Langhan, Chen, Marshall, & Santucci, 2011; Waugh, Epps, & Khodneva, 2011)
- There is also a cost benefit advantage to capnography as evidenced by a decrease in adverse events and a potential cost-avoidance.(Friedrich-Rust et al., 2014)

Conclusion

ARIN endorses the routine use of capnography for all patients who receive moderate sedation/analgesia during procedures in the imaging environment. This position is based on an extensive literature review demonstrating technical superiority and cost advantages with capnography use.

References

- Adams, L., Butas, S., & Spurlock, D., Jr. (2015). Capnography (ETCO₂), respiratory depression, and nursing interventions in moderately sedated adults undergoing transesophageal echocardiography (TEE). *J Perianesth Nurs*, 30(1), 14-22. doi: 10.1016/j.jopan.2013.07.009
- American Society of Anesthesiologists (ASA). (2015). Standards for basic anesthetic monitoring. Retrieved from <http://www.asahq.org/quality-and-practice-management/standards-and-guidelines>
- Beitz, A., Riphaut, A., Meining, A., Kronshage, T., Geist, C., Wagenpfeil, S., . . . von Delius, S. (2012). Capnographic monitoring reduces the incidence of arterial oxygen desaturation and hypoxemia during propofol sedation for colonoscopy: a randomized, controlled study (ColoCap Study). *Am J Gastroenterol*, 107(8), 1205-1212. doi: 10.1038/ajg.2012.136

- Cacho, G., Perez-Calle, J. L., Barbado, A., Lledo, J. L., Ojea, R., & Fernandez-Rodriguez, C. M. (2010). Capnography is superior to pulse oximetry for the detection of respiratory depression during colonoscopy. *Rev Esp Enferm Dig*, *102*(2), 86-89.
- Friedrich-Rust, M., Welte, M., Welte, C., Albert, J., Meckbach, Y., Herrmann, E., . . . Bojunga, J. (2014). Capnographic monitoring of propofol-based sedation during colonoscopy. *Endoscopy*, *46*(3), 236-244. doi: 10.1055/s-0033-1359149
- Langhan, M. L., Chen, L., Marshall, C., & Santucci, K. A. (2011). Detection of hypoventilation by capnography and its association with hypoxia in children undergoing sedation with ketamine. *Pediatr Emerg Care*, *27*(5), 394-397. doi: 10.1097/PEC.0b013e318217b538
- Langhan, M. L., Shabanova, V., Li, F. Y., Bernstein, S. L., & Shapiro, E. D. (2015). A randomized controlled trial of capnography during sedation in a pediatric emergency setting. *Am J Emerg Med*, *33*(1), 25-30. doi: 10.1016/j.ajem.2014.09.050
- Slagelse, C., Vilmann, P., Hornslet, P., Jorgensen, H. L., & Horsted, T. I. (2013). The role of capnography in endoscopy patients undergoing nurse-administered propofol sedation: a randomized study. *Scand J Gastroenterol*, *48*(10), 1222-1230. doi: 10.3109/00365521.2013.830327
- van Loon, K., van Rheineck Leyssius, A. T., van Zaane, B., Denteneer, M., & Kalkman, C. J. (2014). Capnography during deep sedation with propofol by nonanesthesiologists: a randomized controlled trial. *Anesth Analg*, *119*(1), 49-55. doi: 10.1213/ANE.0b013e3182a1f0a2
- Waugh, J. B., Epps, C. A., & Khodneva, Y. A. (2011). Capnography enhances surveillance of respiratory events during procedural sedation: a meta-analysis. *J Clin Anesth*, *23*(3), 189-196. doi: 10.1016/j.jclinane.2010.08.012

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