CLINICAL QUESTION

Does use of capnography in patients receiving procedural sedation/analgesia in the emergency department improve outcomes (through earlier detection of adverse events such as hypoventilation and apnea) compared with monitoring the patient using only vital signs, pulse oximetry, and clinical assessment?

PROBLEM

Medication administration and patient monitoring are routine practices for emergency nurses during procedural sedation and analgesia (PSA) in the emergency department (ED). Standard monitoring of patients undergoing PSA traditionally includes clinician observation, cardiac monitoring, pulse oximetry, and frequent vital sign assessments. Adverse events associated with sedation are usually related to airway or respiratory complications. Capnography, a continuous display of exhaled end-tidal carbon dioxide (ETCO₂) value and waveform, has been shown to detect hypoventilation before changes in vital signs, SpO₂, or clinicians’ observations (Saunders, Struys, Pollock, Mestek, & Lightdale, 2017; Waugh, Epps, & Khodneva, 2011). Unlike SpO₂, measurement of ETCO₂ is less likely to be affected by patient movement or low peripheral perfusion states. Additionally, the use of supplemental oxygen before and during sedation is common and may delay the onset of hypoxia, which can contribute to unrecognized hypoventilation or apnea. Patients with an increased oxygen reserve due to the use of supplemental oxygen take longer to register a decreased SpO₂ reading even after prolonged periods of apnea or upper airway obstruction (Waugh et al., 2011). The completion of the procedure does not end the risk of respiratory depression as evidenced by McQuillen and Steele’s (2000) finding that the highest ETCO₂ levels occurred after the end of the procedure but before the patients returned to their baseline level of consciousness.

Many professional organizations including the American College of Emergency Physicians, American Society of Anesthesiologists (ASA), the American Association of Oral and Maxillofacial Surgeons, American College of Radiology (ACR), American Dental Association (ADA), American Society of Dentist Anesthesiologists, Society of Interventional Radiology, American Academy of Pediatrics [AAP], and the American Academy of Pediatric Dentistry [AAPD] support the use of capnography to detect hypoventilation during PSA (ACR, 2015; ADA, 2016; ASA, 2018; Coté, Wilson, AAP, & AAPD, 2016; Godwin et al., 2014). However, there is no universal agreement that capnographic monitoring should be a standard of care in all cases of PSA because there is no conclusive evidence that it improves patient safety (American Society for Gastrointestinal Endoscopy Standards of Practice Committee, 2018).
<table>
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<tr>
<th>Description of Decision Options/Interventions and the Level of Recommendation</th>
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<td><strong>Capnography Use during Procedural Sedation/Analgesia</strong></td>
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<td>ETCO, is a more sensitive indicator of respiratory depression than standard monitoring during PSA. <em>(ASA, 2018; Anderson et al., 2007; Barnett et al., 2016; Burton et al., 2006; Campbell et al., 2016; Dewdney et al., 2017; Deitch et al., 2010; Godwin et al., 2014; Ishiwata et al., 2017; Klare et al., 2016; Langhan et al., 2015; Li et al., 2018; Lightdale et al., 2006; Parker et al., 2018; Pella et al., 2018; Qadeer et al., 2009; Saunders et al., 2017; Vargo et al., 2002; Waugh et al., 2011)</em></td>
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<td>Capnographic monitoring is associated with a decrease in the incidence and severity of hypoxia during PSA. <em>(ASA, 2018; Campbell et al., 2016; Conway et al., 2016; Deitch et al., 2010; Friedrich-Rust et al., 2014; Godwin et al., 2014; Ishiwata et al., 2018; Klare et al., 2016; Langhan et al., 2015; Lightdale et al., 2006; Mehta et al., 2016; Qadeer et al., 2009; Parker et al., 2018; Saunders et al., 2017; Sivilotti et al., 2010; van Loon et al., 2014; Wall et al., 2017)</em></td>
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<td>Using capnography in addition to standard monitoring during PSA directly improves patient outcomes. <em>(Dewdney et al., 2017; Godwin et al., 2014; Saunders et al., 2017; van Loon et al., 2014; Wall et al., 2017)</em></td>
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**Level A (High)**
- Based on consistent and good quality of evidence; has relevance and applicability to emergency nursing practice.

**Level B (Moderate):**
- There are some minor inconsistencies in quality evidence; has relevance and applicability to emergency nursing practice.

**Level C (Weak):**
- There is limited or low-quality patient-oriented evidence; has relevance and applicability to emergency nursing practice.

**N/R Not Recommended**
- Based upon current evidence.

**I/E: Insufficient evidence upon which to make a recommendation.**

**N/E: No evidence upon which to make a recommendation.**

Access the full clinical guideline at: [https://www.ena.org/practice-research/research/CPG/Documents/CapnographyCPG.pdf](https://www.ena.org/practice-research/research/CPG/Documents/CapnographyCPG.pdf)

ENA Clinical Practice Guidelines (CPGs) are evidence-based documents that facilitate the application of current evidence into everyday emergency nursing practice. CPGs contain recommendations based on a systematic review and critical analysis of the literature about a clinical question. CPGs are created following the rigorous process described in ENA’s Requirements for the Development of Clinical Practice Guidelines. The purpose of CPGs is to positively impact patient care in emergency nursing by bridging the gap between practice and currently available evidence.