

# Extended Monitoring during Endoscopy



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## KEYWORDS

- Gastrointestinal endoscopic sedation • Monitoring • Ventilation • Oxygenation
- Hemodynamics • Continuous electrocardiography • Pulse oximetry • Capnography
- Bispectral index

## KEY POINTS

- Endoscopic sedation improves procedure outcomes but carries a risk of adverse cardiopulmonary outcomes.
- Extended monitoring is designed to reduce sedation-associated adverse events through visual assessment and monitors of physiologic parameters.
- Although the evidence base is limited, the American Society of Anesthesiologists and the American Society of Gastrointestinal Endoscopy recommend direct visual assessment, heart rate and blood pressure monitoring, pulse oximetry, and capnography during endoscopic sedation.
- High-risk patients and those requiring deep sedation warrant more intensive monitoring.
- Several novel techniques are emerging and undergoing study to improve monitoring of ventilation and depth of sedation.

## BACKGROUND

Endoscopic sedation improves technical procedure quality while reducing patient discomfort<sup>1</sup> and is now used nearly universally for gastroenterologic endoscopic procedures in the United States.<sup>2</sup> Depending on the agent and dose administered, 4 levels of sedation may be achieved: minimal sedation (anxiolysis), moderate sedation (ie, conscious sedation), deep sedation, and general anesthesia. According to the American Society of Anesthesiologists (ASA), these stages should be viewed as a fluid continuum<sup>3,4</sup> and are defined by patients' degree of spontaneous ventilation, maintenance of cardiovascular function, and response to verbal and tactile stimuli (**Table 1**).

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Disclosure Statement: This article was jointly written and edited by T. Berzin and N. Mahmud. The authors do not have any funding sources or conflicts of interest to disclose.

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Gastrointest Endoscopy Clin N Am 26 (2016) 493–505

<http://dx.doi.org/10.1016/j.giec.2016.02.006>

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	<b>Minimal Sedation</b>	<b>Moderate Sedation</b>	<b>Deep Sedation</b>	<b>General Anesthesia</b>
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Not able to be aroused even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

*Adapted from* American Society of Anesthesiologists. Continuum of depth of sedation: definition of general anesthesia and levels of sedation/analgesia. 2009. Available at: <http://www.asahq.org/~media/Sites/ASAHQ/Files/Public/Resources/standards-guidelines/continuum-of-depth-of-sedation-definition-of-general-anesthesia-and-levels-of-sedation-analgesia.pdf>. Accessed December 23, 2015.

The concept of sedation as a continuum is crucial, as patients may easily and inadvertently drift beyond intended sedation targets and require rescue to restore ventilatory or cardiovascular function.

Sedating and analgesic medications are not without hazard. Opiates, benzodiazepines, and propofol alter one's level of consciousness, depress spontaneous ventilation, and increase cardiopulmonary risk. In a retrospective analysis involving 324,737 patients undergoing endoscopic sedation, Sharma and colleagues<sup>5</sup> found that 0.9% of cases overall were associated with an unplanned cardiopulmonary complication, with higher incidence in more complicated procedures (esophagogastroduodenoscopy [EGD] 0.6%, colonoscopy 1.1%, endoscopic retrograde cholangiopancreatography [ERCP] 2.1%). Risk factors for these adverse events included ASA class III or greater (**Table 2**), advanced age, inpatient status, and trainee involvement in the procedure.

Recognizing the importance of preventing sedation-associated complications, there is great interest in determining the best practices for extended monitoring during endoscopy. In principle, the goal should be to titrate sedatives or anesthetics to the

ASA I	Normal healthy patients
ASA II	Patients with mild systemic disease
ASA III	Patients with severe systemic disease
ASA IV	Patients with severe systemic disease that is a constant threat to life
ASA V	Moribund patients who are not expected to survive without the operation
ASA VI	Declared brain-dead patients whose organs are being removed for donor purposes

*Adapted from* American Society of Anesthesiologists. ASA physical status classification system. 2014. Available at: <http://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>. Accessed December 23, 2015.

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