

# Monitoring for Nonoperating Room Anesthesia



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## KEYWORDS

- Monitoring • Nonoperating room anesthesia • Office-based anesthesia
- Capnography

## KEY POINTS

- Regardless of the depth of anesthesia provided, it is of paramount importance that all providers administering anesthesia at a remote location adhere to the American Society of Anesthesiologists (ASA) guidelines for standard monitoring.
- The ASA recommends the assessment of oxygenation, ventilation, and circulation during any anesthetic regardless the location or type of anesthetic.
- The use of invasive or noninvasive advanced monitors depends on the complexity of the procedure or the patient's history.

## INTRODUCTION

Procedures requiring nonoperating room anesthesia (NORA) have increased in quantity and complexity during the last 20 years.<sup>1</sup> The etiology of this phenomenon is multifactorial, related to technological advancements, health care improvement, and evolving expectations of patients and providers. Technological advancements have driven new diagnostic, therapeutic, and palliative interventions in order to improve quality of life. Life expectancy has increased, resulting in older more complex patients requiring procedures previously reserved for healthy patients who may not have required sedation. Anesthetic delivery is generally regarded as safe due to technological and pharmacologic improvements, and many nonanesthesiologists now routinely

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Disclosure Statement: None.

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provide sedation.<sup>2</sup> Consequently, personnel working in these locations may not have the advanced training necessary to care for complex patients in nonoperating room settings. The roles of anesthesiologists as members of care teams in nonoperating room locations continue to evolve. Anesthesia providers are now recognized as essential members of health care teams in areas where functions and responsibilities of anesthesia providers had not been previously established or recognized.

The logistics of care delivery in remote locations are complex, as each environment has its unique characteristics and safety requirements (MRI, radiotherapy, gamma-knife). Small procedure suites may not have been originally designed to accommodate anesthesia equipment or providers. New construction of remote locations must have space to accommodate for anesthesia equipment and providers. The safety of anesthetic delivery in remote locations has been enhanced through development of area-specific equipment including nonferromagnetic MRI equipment. The introduction of the electronic health record has improved provider access to patient records, augmenting preoperative assessments while also increasing the efficiency of procedural data collection. Finally, communication between remote locations and the central operating room has been enhanced, with cellular phones and vocera devices for use in emergencies or situations when additional experienced providers are needed.

Closed claims analyses have consistently identified respiratory events as the most common adverse events during NORA, occurring twice as commonly as in the operating room.<sup>3,4</sup> Care was described as suboptimal in 54% of the cases and the event preventable in 32% of cases. Monitored care anesthesia (MAC) was the anesthetic technique in half of the cases. Inadequate oxygenation and ventilation were the most common sources of adverse events.<sup>5</sup> Risk factors associated with complications were extreme of age, ASA-PS of at least 3, obesity, and emergency procedures. Remote location events were associated with more severe injuries (death and neurologic injury).

The American Society of Anesthesiologists (ASA) categorizes sedation in 4 categories, including minimal, moderate and deep sedation and general anesthesia. Only physician anesthesiologists, certified nurse anesthetists (CRNAs) and anesthesia assistants (AAs) are permitted to provide general anesthesia. Sedation may be provided by a heterogeneous group of providers with different training, skills, knowledge and practice patterns, including but not limited to other physicians, dentists, and podiatrists. Regardless of the depth of anesthesia provided, it is of paramount importance that all providers administering anesthesia at a remote location adhere to the ASA guidelines for standard monitoring. The ASA recommends the assessment of oxygenation, ventilation, and circulation during any anesthetic regardless of the location or type of anesthetic. This includes the use of continuous pulse oximetry, capnography, electrocardiogram (ECG), intermittent noninvasive blood pressure, and temperature. The use of invasive or noninvasive advanced monitors depends on the complexity of the procedure or the patient's history.

## **PULSE OXIMETRY**

The introduction of continuous pulse oximetry in the 1980s reduced the incidence of unrecognized perioperative hypoxemia. Continuous pulse oximetry remains an essential monitor and is required by the ASA for all categories of sedation. The principals of pulse oximetry are based on the Beer-Lambert law and the variable absorption of wavelengths of light by different species of hemoglobin (oxyhemoglobin (HbO<sub>2</sub>), deoxyhemoglobin (HbR), methemoglobin (metHb) and carboxyhemoglobin (COHb)).<sup>6</sup> HbO<sub>2</sub> absorbs near infrared light at a wavelength of 940 nm, and HbR absorbs red light at a

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