Anesthesia for Ambulatory Diagnostic and Therapeutic Radiology Procedures

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KEYWORDS

• Ambulatory • Radiology • Anesthesia • Interventional radiology

KEY POINTS

- Protection from ionizing radiation is achieved with appropriate shielding with aprons and acrylic shields, along with maintaining distance from the source.
- The magnet creates projectile risks and may cause interference with the electrocardiogram, whereas the generation of electromagnetic energy may cause significant thermal injury in coiled wires.
- Iodinated contrast may cause severe cardiorespiratory compromise and should be immediately stopped, followed by an assessment of the severity/progression of the reaction and the potential need for supplemental oxygen, fluids, epinephrine, and intubation.
- A discussion should occur between the anesthesiologist and radiologist about potential concerns including length of procedure, level of procedural stimulation, positioning, need for patient cooperation, and recovery.
- There is currently no anesthetic technique that is clearly superior, and the same procedure may be performed under light sedation or a general anesthetic depending on patient characteristics or procedural concerns.

INTRODUCTION

Moderate sedation administered by nurses under the supervision of radiologists is used for most radiology procedures.[1,2] The presence of anesthesiologists is increasing because of the increasing complexity of the procedures and comorbidities of the patients. The radiology suite poses unique challenges to the anesthesiologist because of the physical obstacle of the imaging equipment, the distance from the patient, and the hazards of ionizing radiation or magnetic fields.

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CONTRAST

Intravascular ionized contrast reactions can result in chemotoxic reactions because of the physical properties of the contrast agent. The high osmolality of the contrast results in intravascular fluid shifts and may exacerbate congestive heart failure. In addition, molecular binding, particularly of calcium, may decrease inotropy. Because these reactions are secondary to the properties of the contrast, the severity of the reaction depends on dose and concentration. Patients with congestive heart failure, acute/chronic kidney disease, chronic obstructive pulmonary disease (COPD), and other critical illnesses are at increased risk for intravascular volume shifts, decreased inotropy and contrast-induced nephropathy (**Table 1**).

Contrast-induced nephropathy is likely another chemotoxic reaction resulting from renal artery vasospasm or direct action on renal tubules. Preexisting renal dysfunction is the greatest risk factor, because no reports have been described with normal function. The risk of injury may be diminished by adequate hydration with crystalloids, *N*-acetylcysteine, and sodium bicarbonate.[3,4]

Anaphylactoid reactions result from an undefined immune-mediated reaction.[5] The cause of these reactions is not clear but likely involves the kinin and complement systems, resulting in direct histamine release.[5] Symptoms include hives, nausea, vomiting, pruritus, angioedema, bronchospasm, hypotension, and cardiovascular collapse. The severity of symptoms is not dose dependent and may be triggered by even small amounts of contrast. Treatment includes discontinuing the contrast and may require antihistamines, fluids, supplemental oxygen, steroids, epinephrine, and airway management. A history of asthma or previous anaphylactoid reactions are risk factors and pretreatment with diphenhydramine and steroids should be considered. There is no evidence to suggest that an allergy to seafood or shellfish increases the risk (**Table 2**).[6]

OTHER CONTRAST MEDIA

Gadolinium contrast for a magnetic resonance (MR) imaging study may lead to nephrogenic systemic fibrosis in patients with either acute or chronic kidney disease or injury.[7] Ultrasonography contrast involves the intravenous administration of echogenic microbubbles, and patients with pulmonary hypertension or unstable cardiopulmonary conditions should be closely monitored during and for at least 30 minutes after administration.[8]

MRI

Magnet Safety

The magnetic field poses hazards from static magnetic fields, gradient magnetic fields, and radiofrequency (RF) energy. The American College of Radiology (ACR) guidelines require patients and non-MR personnel to have a safety screening performed by authorized MR personnel before entering zone 3 (**Fig. 1**).[9] The constant static magnetic field of the MR scanner poses the most obvious danger if ferromagnetic objects are within range.[10] Gradient magnetic fields occur with the rapidly changing magnetic fields during image acquisition and may cause excitation of peripheral nerves or cardiac arrhythmias if external leads are present. RF energy produced during image acquisition may be focused by metallic materials such as electrocardiography leads, pulmonary artery catheters, and external pacemaker leads, leading to excessive concentration of RF energy and thermal burns (**Table 3**).[11]

Anesthetic Considerations for MRI

Moderate to severe claustrophobia, anxiety, and fear of the MRI machine occur in 37% of patients, with 5% to 10% of these choosing to abort the scan.[12] Most proceed