# Radiocontrast Media: Applications and Concerns

Radiocontrast media are the agents used to increase the contrast of an image, to enhance the visibility of internal structures in imaging technology. Radiocontrast media can be given orally or intravenously. The agents commonly used are barium-based (orally) and iodinated agents (intravenously). Iodinated contrast agents can also be used intra-arterially, intrathecally, and intra-abdominally.[1] These radiocontrast agents absorb exogenously given X-rays, resulting in decreased exposure on the detector, and thus enhance the contrast. These are different from radiopharmaceuticals used in nuclear medicine which emit radiation and are then detected. Gadolinium-based radiocontrast agents are used for contrast enhancement in magnetic resonance imaging (MRI) and can be given orally or intravenously. These MRI contrast agents function by altering the magnetic properties of the nearby hydrogen nuclei, a mechanism different from X-ray contrast media.[2]

Contrast computed tomography (CT), projectional radiography, and fluoroscopy are the X-ray-based imaging techniques for which X-ray radiocontrast agents are routinely used. Ionic iodinated contrast media contains iodine and is used in contrast CTs, angiography, venography, voiding cystourethrography, hysterosalpingogram, and intravenous urography.[3] Organic or nonionic iodine molecules used for contrast include iohexol, iodixanol, and ioversol.

Barium sulfate is mainly used for contrast of the digestive tract. Various barium studies include barium enema for large bowel investigations, barium swallow for esophageal investigations, barium meal for stomach investigation, and barium follow-through for stomach and small bowel investigation and for virtual colonoscopy. Gastrointestinal motility disorders from pharynx to anus are best detected by barium studies.[4] Air and barium can be used together for double-contrast barium enema. As air is less radiopaque than the tissues, contrast is enhanced.

Gadolinium-containing MRI contrast agents are most commonly used for the enhancement of vessels in MR angiography or for brain tumor enhancement associated with the degradation of the blood–brain barrier. Gadoxetic acid is used as a hepatobiliary agent as 50% is taken up and excreted by the liver and 50% by the kidneys.[5] Iron oxide-, iron platinum-, and manganese-based MRI contrast agents have either being discontinued due to safety concerns or are in advance stage of development.

Are these agents devoid of any adverse potential? Side effects of radiocontrast media range from mild to severe life-threatening reactions. Immediate skin rashes, flushing, urticaria, pruritus, rhinorrhea, nausea, vomiting, diaphoresis, coughing, and dizziness are major mild hypersensitivity reactions (incidence <3%). Major moderate-to-severe (incidence <0.04%) reactions include persistent vomiting, facial edema, laryngeal edema, mild bronchospasm, palpitations, tachycardia or bradycardia, abdominal cramps, angioedema, coronary artery spasm, hypertension or hypotension, life-threatening cardiac arrhythmias, cardiac failure, pulmonary edema, seizures, and syncope. Mortality is <1 death per 100,000 patients.[6] Hypersensitivity reactions to contrast media include both IgE- and non-IgE-mediated anaphylaxis.[7]

Delayed adverse reactions to radiographic contrast media are usually cutaneous and include rash, skin redness, and skin swelling, sometimes associated with nausea, vomiting, and dizziness.[7] Iodinated contrast media exposure may be associated with development of either hyperthyroidism or hypothyroidism and the strength of the exposure depends on the concentration of free iodine present.[8] Iodinated contrast-induced thyrotoxicosis, though rare, is a possibility. Contrast-induced nephropathy is another source of hospital-acquired morbidity and mortality due to contrast media.[7]

Gadolinium has a general depressant activity on all systems. Its adverse effects include hypotension, hypertension, tachycardia, migraine, syncope, vasodilatation, pallor, abdominal discomfort, teeth pain, increased salivation, abdominal pain, vomiting, diarrhea, agitation, anxiety, diplopia, loss of consciousness, convulsions, paresthesia, pruritus, urticaria, and facial edema. Death is usually due to cardiovascular collapse and respiratory paralysis.[5]

As is clear, radiocontrast media, though very useful, can cause great deal of discomfort and adverse reactions. Studies on the effect of radiocontrast media at the molecular level must be undertaken, to unlock the mechanisms causing adverse effects of drugs and possible interventions for that. In this issue, a research article elucidating the effect of iodinated contrast media on serum electrolytes concentrations is being published and that will greatly enhance our current knowledge on the issue.[9]

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