'HEAD TO TOE'

A MESSAGE FROM THE DESK OF RADIOLOGY ASSOCIATES

Non-Allergic IV Contrast Complications

by David D. Wilson, M.D.

Contrast agents are commonly used in a variety of CT and MR imaging examinations to more precisely diagnose disease. Complications from their use can be defined as either allergic or non-allergic. Common adverse events may directly cause contrast-induced nephropathy (CIN) or may indirectly be mediated by renal insufficiency. Therefore, renal insufficiency plays a role in all common non-allergic IV contrast complications. The following is a summary of current thinking with their use, as discussed in the 2013 version of the *American College of Radiology (ACR) Manual on Contrast Media*.

Contrast Induced Nephrotoxicity (CIN) is defined as a sudden deterioration in renal function following IV iodinated contrast use. It is believed to be due to both osmotic and chemotoxic mechanisms, and is dose related. With the use of faster multichannel CT, the volume of contrast used for most imaging exams has been reduced from 120 - 150 mL to 80 mL. With radiographic contrast using iodine, CIN has become less common when non-ionic low osmolar contrast replaced ionic high osmolar contrast in the 1990's.

Availability of on-site testing of serum creatinine has simplified screening for chronic renal insufficiency in patients deemed at higher risk for chronic renal insufficiency. These changes have served to reduce the incidence of CIN in patients undergoing imaging studies using iodinated contrast. As with any nephrotoxic medication, adequate hydration is a key for prevention of CIN. Meta-analysis of patients undergoing contrast studies using medication thought to be useful for prevention of CIN such as sodium bicarbonate, N-acetyl cysteine, mannitol and furosemide are inconclusive as to their efficacy in prevention of CIN. Serum creatinine is required in all patients over 60 years of age, history of renal disease, history of hypertension, diabetes or taking Metformin medication.

There is generally an acceptance that iodinated contrast should not be given in patients with creatinine above 1.5 - 2.0 mg/dL, but the cutoff is not clearly defined. In our practice, any patient with a serum creatinine between 1.8 - 2.0 mg/dL may be given iodinated contrast only if there is a clear indication for its use. Patients with creatinine above 2.0 mg/dL may not receive iodinated contrast unless the patient is undergoing chronic hemodialysis and is oliguric.

In patients using the oral anti-hyperglycemic drug Metformin, a rare adverse effect may occur. Severe life-threatening lactic acidosis may develop in certain patients with renal insufficiency and liver/cardiovascular disease. The major event mediating this complication is impaired Metformin excretion by patients with renal insufficiency, in association with comorbid risk factors such as liver disease impairing metabolism of lactate such as cirrhosis, alcoholic liver disease or ischemic heart disease/CHF. ACR recommendations for patients using Metformin and receiving IV contrast are: 1) if renal function is normal and there are no comorbidities, patient does not require discontinuance of Metformin or post procedure serum creatinine to assess renal function; 2) if renal function is normal, but there are comorbid risks, Metformin should be discontinued for 48 hours following IV contrast administration and an alternative medication for the management of diabetes should be used but there is no need for renal function testing for the resumption of Metformin; and 3) if renal function is abnormal, Metformin is discontinued at the time of use of IV contrast and should not be resumed until follow-up serum creatinine demonstrates stable renal function.

Magnetic resonance studies using Gadolinium (GD) contrast agents have no known nephrotoxicity at approved dosages for MR. However, a serious complication may occur in patients with renal insufficiency in which the patient can develop Nephrogenic Systemic Fibrosis (NSF), a fibrosing disease principally involving the skin and subcutaneous tissues, initially causing skin thickening/pruritus but leading to contractures and joint immobility. The mechanism for development of NSF is unclear, but is thought to be related to disassociation of GD from its chelate due to impaired excretion with deposition into the skin and other target organs. The key risk factor for this complication is renal insufficiency with those with more severe impairment at higher risk. The incidence of development of NSF is thought to be between 1 - 7% in patients receiving the agent who had a GFR between 15 - 30. Patients are screened using the same risk factors as with iodinated contrast, with those patients at risk undergoing serum creatinine/GFR testing prior to the exam.

ACR recommendations for the use of Gadolinium in patients with renal impairment are: 1) patients with end stage renal insufficiency on dialysis should not receive GD; 2) patients with GFR< 30 should not receive GD and those with GFR 30 - 40 are reviewed to determine if there is a clear indication for its use; 3) patients with GFR between 30 - 60 should receive a contrast agent that has a low reported incidence of NSF such as Prohance; and 4) patients with a GFR above 60 may receive GD.

David D. Wilson, M.D.
Radiology Associates