RADIOLOGY NEWS

Radiology Associates of Atlanta **1/8/2014** [Edition 1, Volume 1]

CONTRAST INDUCED NEPHROPATHY AND DIAGNOSTIC CT

Contrast media induced nephropathy (CIN) leading to acute renal failure is a rare event associated with iodinated contrast agents. Several studies published recently in *Radiology (1-3)* suggest the risk of contrast induced nephropathy (CIN) following intravenous iodinated contrast administration is much lower than previously believed. In this article we provide an update on recent revisions to our policy for IV contrast administration for CT and provide a practical approach to CIN prevention through risk stratification and prophylaxis.

Predisposing Risk Factors

Patients with the highest risk of developing CIN are those with pre-existing renal insufficiency or chronic kidney disease. Other risk factors include diabetes, dehydration, congestive heart failure, age > 60, certain medications including non-steroidal anti-inflammatory agents (NSAIDS), and recent prior iodinated contrast administration. The combination of renal insufficiency and diabetes is particularly problematic.

Although high serum creatinine levels have traditionally been regarded as an indicator of renal insufficiency, it is now recognized that creatinine levels in isolation are a poor measure of renal function as they vary with muscle mass Therefore, current recommendations are that the estimated glomerular filtration rate (eGFR), as calculated using the Modification of Diet in Renal Disease (MDRD) equation, be used to determinate baseline renal function. eGFR is now often provided along with serum creatinine by hospital laboratories.

- **Recent studies indicate the risk of iodinated contrast media induced nephropathy (CIN) is lower than previously believed**
- **There is no universally agreed upon threshold below which contrast should not be administered, but experts now suggest that an eGFR of ≥ 45 in the setting of chronic renal insufficiency is safe for most patients**
- **Predisposing factors for iodinated contrast media induced nephropathy (CIN) include chronic renal insufficiency, diabetes, dehydration, congestive heart failure, nephrotoxic medications, and age**
- **For those with predisposing factors, an estimated glomerular filtration rate (eGFR) should be calculated to stratify risk**
- **For those at highest risk, iodinated contrast agents should be avoided unless absolutely necessary**
- **For those at intermediate risk, prevention is recommended, including hydration and cessastion of nephrotoxic medications**

Prior to a patient undergoing contrast-enhanced CT study, a comprehensive medical history must be obtained to identify any predisposing factors for CIN. Patients with risk factors will require a serum creatinine level to calculate the eGFR prior to the study.

Policy Change Effective 12/2013

At Piedmont Atlanta, Radiologists previously assessed all patients with eGFR <60 on a case by case basis to* determine *whether contrast should be administered. Frequently, contrast had been withheld in these patients. Based on recent evidence, we no longer withhold iodinated contrast for patients with chronic kidney disease with eGRF above 45.

(SEE GUIDELINES PG 4)

Acute Kidney Injury Patients

In patients with acute kidney injury, the administration of iodinated contrast medium should only be undertaken with appropriate caution and only if the benefit to the patient clearly outweighs the risk. There has been no published series demonstrating that IV iodinated contrast medium administration to patients with acute kidney injury leads to worse or prolonged renal dysfunction than would occur in a control group. However, patients with acute kidney injury are particularly susceptible to nephrotoxin exposure and therefore it is probably prudent to avoid intravascular iodinated contrast medium in these patients (when possible), regardless of the generally low nephrotoxic risk. (4)

Renal Dialysis Patients and the Use of Iodinated Contrast Medium

Patients with anuric end-stage chronic kidney disease can receive intravascular iodinated contrast medium without risk of further renal damage because their kidneys are no longer functioning. However, there is a theoretical risk of converting an oliguric dialysis patient to an anuric dialysis patient by exposing him or her to intravascular iodinated contrast medium. This remains speculative, as there are no conclusive outcome data in oliguric dialysis patients in this setting.

Patients receiving dialysis are also at theoretical risk from the osmotic load imposed by intravascular iodinated contrast medium because they cannot clear the excess intravascular volume. This osmotic load can theoretically result in pulmonary edema and anasarca. To mitigate this possible risk, contrast medium dosing should be as low as necessary to achieve a diagnostic result (as in all patients).

Contrast agents are not protein-bound, have relatively low molecular weights, and are readily cleared by dialysis. Unless an unusually large volume of contrast medium is administered or there is substantial underlying cardiac dysfunction, there is no need for urgent dialysis after intravascular iodinated contrast medium administration (5).

Metformin

Intravascular administration of iodinated contrast media to a patient taking metformin is a potential clinical concern. Of metformin-associated lactic acidosis cases reported worldwide between 1968 and 1991, 7 of the 110 patients received iodinated contrast media before developing lactic acidosis. The metformin package inserts approved by the U.S. Food and Drug Administration state that metformin should be withheld temporarily for patients undergoing radiological studies using IV iodinated contrast media. If acute renal failure or a reduction in renal function were to be caused by the iodinated contrast media, an accumulation of metformin could occur, with resultant lactate accumulation. The major clinical concern, then, is confined to patients with known, borderline, or incipient renal dysfunction. (4)

References

1. McDonald JS, McDonald RJ, Comin J, et al. Frequency of acute kidney injury following intravenous contrast medium administration: a systematic review and meta-analysis. Radiology 2013;267(1):119–128.
2. Davenport MS, Khalatbari S, Dillman JR, Cohan RH, Caoili EM, Ellis JH. Contrast material–induced nephrotoxicity and intravenous low-osmolality iodinated contrast material. Radiology 2013;267(1):94–105.
3. McDonald RJ, McDonald JS, Bida JP, et al. Intravenous contrast material–induced nephropathy: causal or coincident phenomenon? Radiology 2013;267(1):106–118)
4. ACR Manual on Contrast Media, Version 9, 2013. ACR Committee on Drugs and Contrast Media.
5. Younathan CM, Kaude JV, Cook MD, Shaw GS, Peterson JC. Dialysis is not indicated immediately after administration of nonionic contrast agents in patients with end-stage renal disease treated by maintenance dialysis. AJR Am J Roentgenol 1994; 163:969-971.

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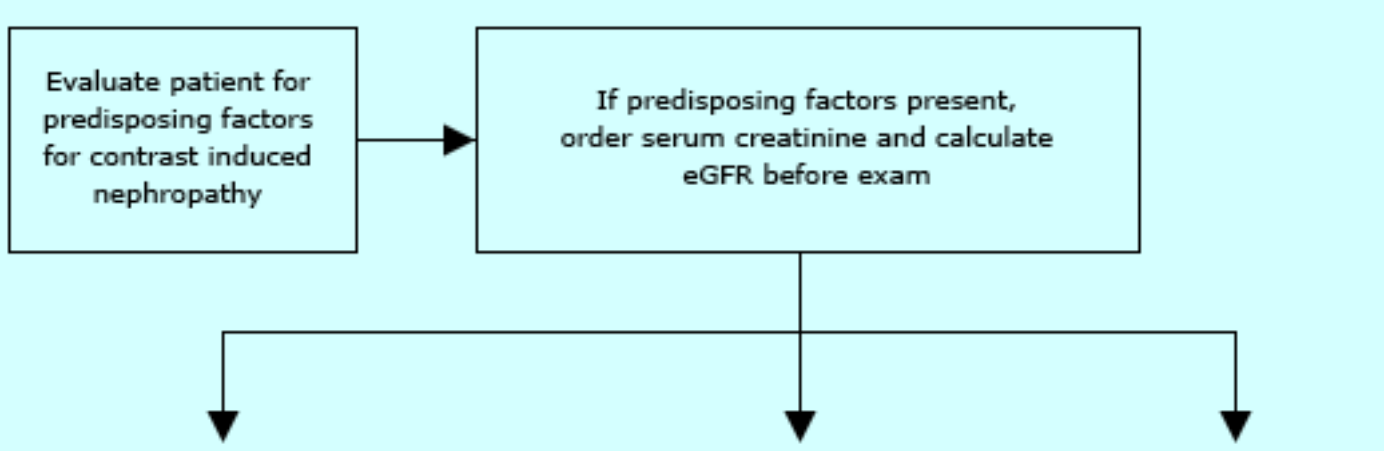
Guidelines for risk stratification and prophylaxis for CIN



	High Risk	**Intermediate Risk**	**Low Risk**
	Estimated GFR < 30 mL/min/1.73 m^2	Estimated GFR 30-45mL/min/1.73 m2	Estimated GFR > 45 mL/min/1.73 m2
Contrast Administration	Avoid contrast*	Administer contrast if determined indicated	Administer contrast if determined indicated
Oral Hydration	N/A	Encouraged, starting on day prior to examination	Encouraged, starting on day prior to examination
IV Hydration	N/A	Requires CSU bed for outpatients. Normal (0.9%) saline infused at 1 mL/kg for 6 hours prior to and 4 hours after contrast administration	N/A
Metformin	N/A	Discontinue at time of contrast administration. Resume 48 hours after if no evidence of CIN	Discontinue at time of contrast administration. Resume 48 hours after. If the patient had normal renal function at baseline, was clinically stable,and had no intercurrent risk factors for renal damage (e.g., treatment with aminoglycosides, major surgery, heart failure, sepsis, repeat administration of large amounts of contrast media), metformin can be restarted without repeating the serum creatinine measurement.