LETTERS TO THE EDITOR

Regarding "Safety of gadolinium contrast angiography in patients with chronic renal insufficiency"

In a well-performed study, Sam et al (J Vasc Surg 2003;38: 313-8) reported a 9.5% incidence of contrast medium–induced nephropathy (CIN) when using gadopentetate, a gadolinium-based contrast medium (Gd-CM), for x-ray angiography in patients with renal dysfunction. Unfortunately, they stated, "Despite this, Gd-CM appears to be approximately 20 times safer than iodinated agents in patients with renal compromise."

This statement is most likely wrong for two reasons. First, use of Gd-CM as an alternative to iodinated agents for x-ray diagnostic angiography and interventions in patients with compromised renal function has been opposed in a recent review on the physicochemical properties of CM with regard to attenuation and toxicity.[1] The conclusions from this review were as follows:

1. Any comparison regarding nephrotoxic effects between CM intended for use in x-ray angiography should be made at concentration and doses resulting in the same diagnostic information, ie, equal attenuation of x-rays.
2. No such comparative data have been presented by those who advocate the use of Gd-CM in azotemic patients.
3. Iodine-based contrast media (I-CM) at a concentration of 63 mg I/mL contain the same number of attenuating iodine atoms as gadolinium atoms in a 0.5 mol/L Gd-CM solution.
4. I-CM at a concentration of about 60 to 80 mg I/mL seems to result in the same attenuation as 0.5 mol/L Gd-CM at the commonly used 70-90 kV used for digital subtraction angiography.
5. CM osmolality is a pathogenetic factor in CIN. Commercially available solutions of iodine-based contrast agents can be diluted to isotonic solutions of 60 to 80 mg I/mL, while the osmolality of 0.5 mol/L gadopentetate is about 7 times that of plasma, 1960 mOsmol/kg.
6. Using equal-attenuating doses, the general toxicity of various Gd-CM may be about 6 to 25 times that of I-CM in animal experiments.

Second, in an experimental unilaterally nephrectomized porcine model, about 60 mL of various test solutions were selectively injected into the balloon-occluded remaining renal artery. Isotonic solutions of one of the iodine-based contrast media (iohexol), 70 mg I/mL, had no effect on glomerular filtration different from that of saline injected without ischemia, while the hypertonic solution of gadopentetate caused almost complete cessation of renal function.[2]

In conclusion, the use of hyperosmolar Gd-CM such as gadopentetate instead of equal attenuating isotonic solutions of I-CM should be strongly discouraged for x-ray angiography since equal attenuating solutions of I-Cm are at least 20 times safer than gadopentetate!

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REFERENCES

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Reply

We thank Dr Nyman for his kind interest in our recently published article and we thank the Journal Editors for this opportunity to respond to his letter. Dr. Nyman's work in this area has certainly helped us to better understand the potential complications that can arise from the use of all types of contrast media.

We agree with Dr Nyman's ultimate conclusion that the intravenous administration of gadopentate (Gd-CM), a strongly hyperosmolar contrast agent, has the potential to be clinically nephrotoxic. We would like to take this opportunity to reiterate the importance of the guidelines for Gd-CM use. The agent should be administered only for approved indications and in dosages that are within safe, recommended ranges. We believe that this holds true for patients both with and without baseline renal insufficiency.

Perhaps some confusion has arisen from our statement that "gadolinium-based contrast agents appear to be approximately 20 times safer than iodinated agents in patients with renal compromise." We were referring to its administration alone, in recommended quantities, during magnetic resonance imaging. Like Dr Nyman, we do not believe that Gd-CM is any safer than iodinated contrast (I-CM) when used in an off-label manner for x-ray angiography. Specifically, Gd-CM is likely no safer than I-CM when used intra-arterially "as an alternative to iodinated agents for x-ray diagnostic angiography and interventions" either alone or in combination with I-CM. Perhaps our message has been misunderstood. Our intent was to make clear that magnetic resonance imaging with doses of Gd-CM at 0.02 to 0.03 mmol/kg are safer than x-ray digital subtraction angiography with iodinated contrast.

We also agree that "contrast media osmolality is a pathogenic factor in contrast-induced nephropathy" but, to date, no comparative data between I-CM and Gd-CM at equivalent dosages and concentrations are available upon which one can base a final conclusion regarding either agent's relative propensity toward causing clinically significant renal compromise.

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