Contrast-induced nephropathy

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TO THE EDITOR: Thank you for the very interesting and complete article by Dr. Michael Rudnick and colleagues on preventing contrast-induced nephropathy.[1] After reading this article, I feel as though I have a much better understanding of the topic. However, I have a couple of questions regarding which fluids to use and when and how to administer the extra measures such as sodium bicarbonate and *N*-acetylcysteine.

• *Should we use normal (isotonic) saline or half-isotonic (ie, 0.45%) saline?* Rudnick et al cite a study by Solomon et al[2] in which patients received 0.45% saline intravenously at 1 mL/kg/hour for 12 hours before and for 12 hours after a contrast load. At the end of the article (in the sidebar on page 85 and in the last paragraph on page 86) the authors recommend that we start saline hydration 2 to 4 hours before the procedure and continue 4 to 6 hours after. My question is, do we use normal saline or half-isotonic saline? If the authors recommend normal saline, there is nothing in the article that supports that as an option.

• *What should I do if I choose to use* N*-acetylcysteine, sodium bicarbonate, or both along with saline hydration?* It does not seem right to give normal saline (or half-isotonic saline, depending on the answer to my question above) hydration for 2 to 4 hours plus *N*-acetylcysteine 150 mg/kg in 500 mL normal saline to run in over 30 minutes before a procedure, plus three ampules of sodium bicarbonate in 1 L of dextrose 5% in water to run at 3 mL/kg/hour for 1 hour before a procedure. The osmolality of the fluid would not be appropriate if all three or even any two were given at the same time. Additionally, there would be a lot of fluid being administered, about 800 mL, in that first hour before the procedure.

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IN REPLY: Dr. Anapoell's letter illustrates the ambiguities surrounding hydration recommendations for the prevention of contrast-induced nephropathy.

Preprocedure and postprocedure hydration periods of 12 hours each in high-risk patients were the standard for most clinical studies of contrast-induced nephropathy. Then came the publication of the Solomon study,[2] which showed equivalent or superior prophylactic efficacy of hydration alone compared with hydration with either mannitol or furosemide. Subsequently, clinical practice has changed so that the vast majority of coronary angiography procedures are now being performed in the outpatient setting, even in high-risk patients. This has resulted in the use of shorter hydration periods, both in clinical practice and in formal clinical trials of contrast-induced nephropathy. Furthermore, no clinical trial has compared shorter preprocedure and postprocedure hydration periods with 12-hour preprocedure and postprocedure hydration periods. In recent trials, shorter hydration periods do not appear to be associated with an increase in the incidence of contrast-induced nephropathy, but this observation could be due to factors other than the length of hydration.

At present, I think a conservative recommendation in diabetic patients with moderate to severe chronic kidney disease is to use isotonic (normal) saline at 1 mL/kg/hour starting 6 to 12 hours before and continuing for 6 to 12 hours after contrast administration. Somewhat shorter hydration periods, 4 to 6 hours each for the precontrast and postcontrast periods, can be considered in nondiabetic patients with mild chronic kidney disease. The recommendation to use normal saline as opposed to 0.45% normal saline is based on a single large prospective randomized trial comparing both solutions, which found superior prophylactic effect in patients who received the normal saline solution.[3]

The possible value of *N*-acetylcysteine and bicarbonate further complicates the hydration regimen, as outlined by Dr. Anapoell. The data on the value of *N*-acetylcysteine are conflicting,[4] but due to its

low cost, minimal toxicity, and potential prophylactic efficacy, it is reasonable to continue to recommend its use as an oral dose 600 mg twice a day the day before and the day of contrast administration. I would not advocate intravenous *N*-acetylcysteine, due to extremely limited and conflicting data as to its value.[5,6]

So far, data supporting the efficacy and possible superiority of intravenous bicarbonate over normal saline come from only one study,[7] and thus, bicarbonate cannot be recommended as the standard hydration regimen at the present time. If there is insufficient time for adequate hydration with normal saline, the bicarbonate regimen (3 mL/kg isotonic bicarbonate for 1 hour prior to contrast and for 6 hours after contrast) would be a reasonable alternative.

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REFERENCES

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4. **Nallamothu BK, Shojania KG, Saint S, et al.** Is acetylcysteine effective in preventing contrast-related nephropathy? A meta-analysis. Am J Med 2004; 117:938–947.
5. **Baker CS, Wragg A, Kumar S, De Palma R, Baker LR, Knight CJ.** A rapid protocol for the prevention of contrast-induced renal dysfunction: the RAPPID study. J Am Coll Cardiol 2003; 41:2114–2118.
6. **Webb JG, Pate GE, Humphries KH, et al.** A randomized controlled trial of intravenous *N*-acetylcysteine for the prevention of contrast-induced nephropathy after cardiac catheterization: lack of effect. Am Heart J 2004; 148:422–429.
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CME ANSWERS

Answers to the credit test on page 406 of this issue

1 **C** 2 **D** 3 **A** 4 **D** 5 **B** 6 **B** 7 **B** 8 **E** 9 **C**
10 **E** 11 **D** 12 **D** 13 **B** 14 **B** 15 **C**