Delayed Renal Visualization During Hepatobiliary Scintigraphy

Visualization of the kidneys during hepatobiliary scintigraphy using technetium-99m-\(^{99m}\)Tc labeled N-substituted iminodiacetic acid agents is often the consequence of severe hepatic dysfunction or biliary tract obstruction (1-3). We report a case of delayed renal visualization seen during hepatobiliary imaging with \(^{99m}\)Tc-diisopropyl-iminodiacetic acid (DISIDA) where no evidence for severe hepatic dysfunction or biliary tract obstruction was found.

A 24-yr-old woman underwent hepatobiliary scintigraphy after complaining of recurrent right upper quadrant abdominal pain, nausea, and vomiting. She was 5 wk postpartum and taking cimetidine and dicyclomine hydrochloride. Prior to admission, she had been breast-feeding. Physical examination revealed that she had epigastric tenderness along the right costal margin. Laboratory values revealed normal liver and renal function. Cholelithiasis was discovered on ultrasonography.

Hepatobiliary scintigraphy (7.3 mCi of \(^{99m}\)Tc-DISIDA) showed prompt uptake of the radiotracer within the liver. Slight visualization of renal activity was seen in the 20 min postinjection image. By 25 min postinjection, this activity was no longer seen. By 50 min postinjection, a suggestion of radiotracer activity was noted within the gallbladder and a large amount of activity was seen within the bowel. A 2-hr postinjection image of the anterior abdomen clearly revealed localization of the radiotracer within the cortices of both kidneys, the gallbladder, and the gastrointestinal tract. Faint activity is also seen within both breasts. A 3-hr postinjection scintigram of the chest and the abdomen with the patient in the lateral (Fig. 1A) and in the anterior (Fig. 1B) positions demonstrated breast, renal, and gallbladder localization of the radionuclide.

Our case demonstrates delayed renal localization of activity after administration of the \(^{99m}\)TcDISIDA in a patient without marked liver disease or biliary tract obstruction. Since \(^{99m}\)Tc-iminodiacetic acid (IDA) derivatives are known to be relatively stable in vivo up to 24 hr, early breakdown of the radiopharmaceutical as a mechanism for its localization in tissues outside the hepatobiliary system seems unlikely (4).

Experience with hepatobiliary imaging reveals that delayed renal visualization is not usually observed unless liver disease or biliary obstruction is present. In addition to this case, we have seen three other cases which demonstrated atypically delayed renal cortical uptake during hepatobiliary scintigraphy using \(^{99m}\)TcDISIDA. Incidental breast localization of the radiotracer was seen in two of the cases. Liver function tests were completely normal in two cases and mildly abnormal at the time of imaging in the other case. No evidence for common bile duct obstruction was seen in any of the cases at the time of imaging. One case, however, had a clinical course which suggested recent common bile duct obstruction. Renal function was normal in all the cases.

A major impurity in the administered radiopharmaceutical, such as \(^{99m}\)Tc-pertechnetate, could have been responsible for the radiotracer uptake by the kidneys and the breasts (5,6). We dismiss this as the sole explanation for a number of reasons. There was less than 0.1% of \(^{99m}\)Tc-pertechnetate as an impurity in the \(^{99m}\)TcDISIDA preparations given to our patients as determined by chromatography using the specially designed quality control strips for DISIDA.* There was less than 15 min between preparation and injection of the \(^{99m}\)TcDISIDA. There was little possibility of oxidation of the radiopharmaceutical prior to injection. Finally, the images obtained from our cases do not resemble images that would be expected with a significant early free pertechnetate contaminant. There was no substantial localization of the radiotracer within the stomach, kidneys, or thyroid of our patients during the first hour of imaging. Instead, our patients studies showed a progressive delayed accumulation of radioactivity within the cortex of each kidney and within the breasts in two of the cases.

The possibility of a radiopharmaceutical impurity or impurities developing in vivo in our cases due to early breakdown of an usually stable molecule or a modification of the existing radiotracer must be considered. This, of course, would not be detected by routine chromatography. The characterization of such molecular changes, if they occur, is not known. Perhaps,
soluble low molecular weight protein complexes are excreted in the urine or are localized in renal parenchyma; and oxidized, free pertechnetate is excreted by the gut, breast, oropharynx, and stomach.

What leads to the changes from normal localization of $[^{99m}Tc]$DISIDA in our cases is not known. All our cases involved women, three of whom were postpartum, two of whom were breast-feeding. The remaining woman was taking oral contraceptives. The possibility exists that changes in the hormonal environment of our patients may have had a role in a delayed instability of $[^{99m}Tc]$ iminodiacetic acid derivatives. In another report, delayed visualization of the breast was noted during hepatobiliary imaging using $[^{99m}Tc]$p-isopropyl iminodiacetic acid (PiPIDA) in a man ingesting large quantities of conjugated estrogens (7). This further supports the hormonal hypothesis.

Footnote
* Nuclear Pharmacy, Inc., Albuquerque, NM.

References

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Correction: Mislabeling of Figures in Special Contribution

Figures 2 and 3 (left, right) were mislabeled in the Special Contribution, “Horizons in Radionuclide Therapy: 1985 Update,” J Nucl Med 26:421-427, 1985. Figure 2 should be labeled correctly as Figure 2b and Figure 3 (left, right) should be labeled correctly as Figure 2a and 2c.

Correction: Unit of Measure in Letter to the Editor

The unit of measure for the Letter to the Editor, “Estimates of Left Ventricular Volumes by Equilibrium Radionuclide Angiography: Importance of Attenuation Correction.” J Nucl Med 26:317-318, 1985 was incorrectly stated as “cm”. The correct unit of measure should be “cm$^{-1}$".
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