

# Prompt Visualization of the Gallbladder with a Rim Sign—Acute or Subacute Cholecystitis?

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An immunosuppressed, neutropenic patient developed symptoms and signs of acute cholecystitis. Gallbladder ultrasound was consistent with acute cholecystitis. Technetium-99m-diisopropyl iminodiacetic acid (DISIDA) scan showed a rim sign, but with normal gallbladder visualization. On restudy 72 hr later when the patient's WBC count was recovering, the  $^{99m}\text{Tc}$ -DISIDA scan again showed a persistent rim sign, but now there was no gallbladder visualization at 1 hr, a pattern strongly predictive for acute complicated cholecystitis. Biliary drainage was performed by percutaneous cholecystotomy with clinical improvement. Semielective cholecystectomy performed 8 wk later confirmed both acute and chronic cholecystitis. We describe the rim sign and its variants, mechanisms of causation, prognostic importance and correlate our report with a review of the literature.

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**O**n iminodiacetic acid (IDA) scans, photointense pericholecystic hepatic activity adjacent to the gallbladder fossa (PCHA or rim sign) correlates well with the presence of acute cholecystitis (1–3). When associated with nonvisualization of the gallbladder at 1 hr, the positive predictive value of a rim sign for acute complicated cholecystitis is 94% (3–5). We present a case where a rim sign was present on a  $^{99m}\text{Tc}$ -diisopropylimidoacetic (DISIDA) scan, but with prompt gallbladder visualization in an immunosuppressed patient, after bone marrow transplant. The rim sign was seen early in the hepatic phase prior to filling of biliary radicals and persisted throughout the study. On restudy of the same patient 72 hr later, a rim sign was again present, but the gallbladder did not visualize at 1 hr, findings strongly predictive for acute complicated cholecystitis.

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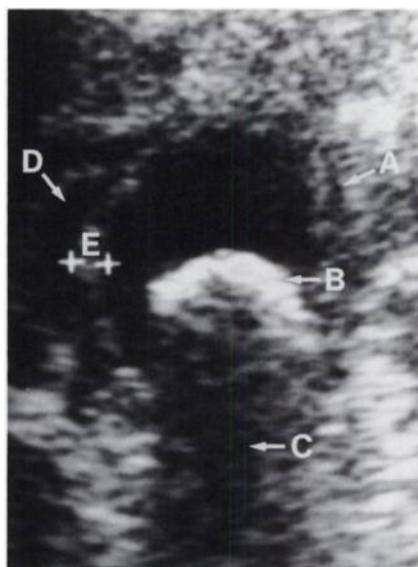
## CASE REPORT

A 42-yr-old Filipino male underwent autologous bone marrow transplantation for progressive multiple myeloma. He did well until the 17th day post-transplant, when he developed rigors and spiked a temperature to 101.8°F. Chest radiograph was clear and a thorough physical exam revealed no clinically apparent source of infection.

In spite of institution of appropriate broad spectrum antibiotics, his temperature continued to rise and he began to complain of nausea, with epigastric and right upper quadrant discomfort.

On the 19th day post-transplant, physical exam showed abdominal distension with right upper quadrant tenderness. Real time right upper quadrant sonography (Fig. 1) revealed several mobile shadowing stones within the gallbladder with a sonographic Murphy's sign. The gallbladder wall was thickened, measuring 1.0 cm, and fluid was noted within the wall itself. Pericholecystic fluid was identified. The common bile duct measured 2.2 mm. A  $^{99m}\text{Tc}$ -DISIDA scan was performed using an intravenous injection of 8.0 mCi  $^{99m}\text{Tc}$ -DISIDA after cholecystikinin (Sincalide) injection, 0.04  $\mu\text{g}/\text{kg}$ . Data were acquired with a low-energy, all-purpose collimator at 2.5 min per frame from the anterior position. A rim sign was visualized early in the hepatic phase and persisted throughout the study, but with prompt gallbladder filling (Fig. 2). No bowel activity was seen at 1 hr but was present 10 min after a second dose of Sincalide.

Over the next 72 hr, the patient's abdominal symptoms and



**FIGURE 1.** Real-time transverse sonographic image of the gallbladder demonstrates an arcuate focus of increased echogenicity (B) with posterior acoustic shadowing (C) diagnostic of cholelithiasis. Associated findings include thickened gallbladder wall (E) with intramural edema (A) and pericholecystic fluid (D).

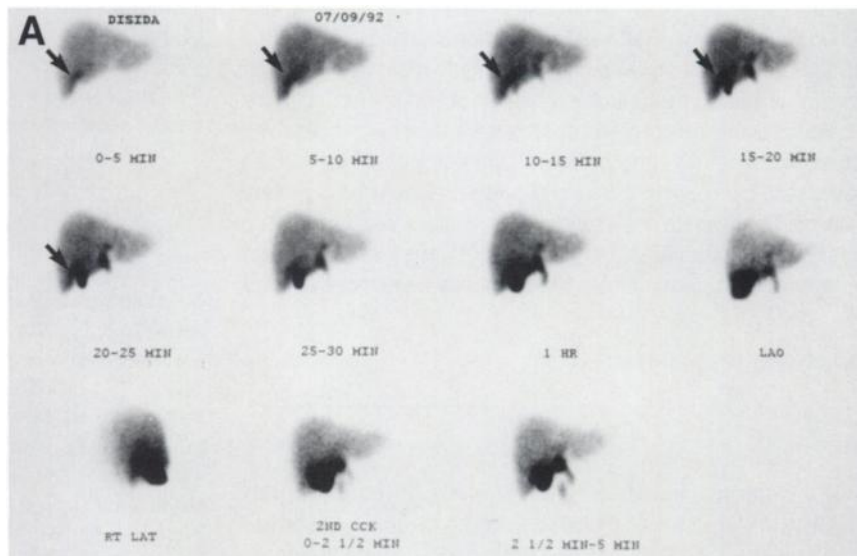
fevers continued. A repeat  $^{99m}\text{Tc}$ -DISIDA scan was done 22 days post-transplant after Sincalide prep and intravenous injection of 7.6 mCi  $^{99m}\text{Tc}$ -DISIDA. Again there was a persistent rim sign, but no gallbladder visualization at 1 hr, findings strongly predictive for acute complication cholecystitis (Fig. 3). Immediately following the second DISIDA scan, the patient underwent gallbladder decompression using percutaneous cholecystotomy. Very thick, viscous bile was obtained. On contrast injection with Conray-60, the cystic duct could not be identified. After 5 days of biliary drainage and clinical improvement, reinjection of contrast showed a patent cystic duct with filling of the left and right hepatic ducts, common bile duct and intestine in a normal pattern. Semielective cholecystectomy 8 wk later confirmed both acute and chronic cholecystitis.

## DISCUSSION

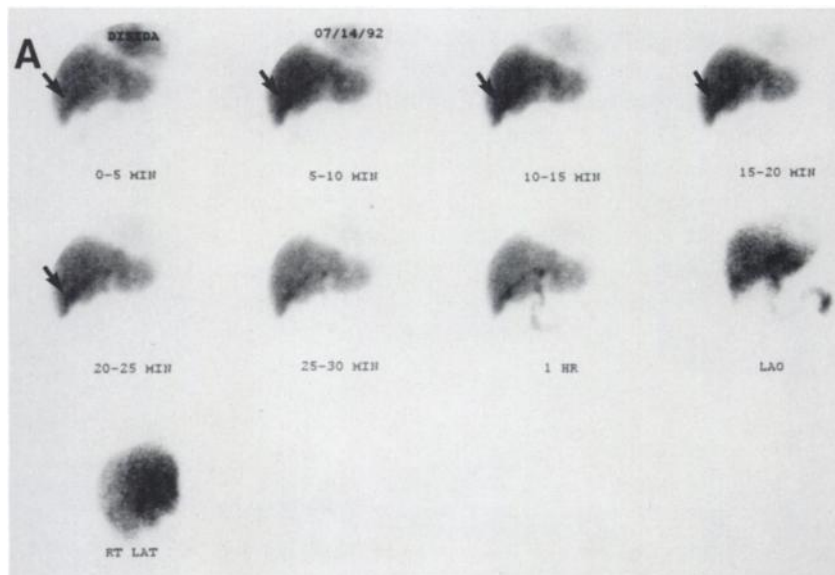
Photointense pericholecystic hepatic activity (PCHA), also known as the rim sign, can be seen with either  $^{99m}\text{Tc}$ -

IDA or  $^{99m}\text{Tc}$ -sulfur colloid scanning (6). With  $^{99m}\text{Tc}$ -IDA scanning, PCHA is always visualized within the first hour postinjection and can be seen early in the hepatic phase, prior to filling of biliary radicals, as in our patient (3,7). Usually seen as a photointense crescentic rim surrounding a photopenic (nonvisualized) gallbladder fossa, photointense PCHA is produced by increased flow and/or impaired hepatocyte radionuclide excretion. If round instead of crescentic in appearance, PCHA can be mistaken for the gallbladder when there is absence of gallbladder filling, the so called "phantom gallbladder" (7). Another variant of the rim sign is the exaggerated gallbladder fossa. Thought to represent a later stage of the rim sign, this variant is caused by the impairment of radionuclide uptake and concentration and produces a photopenic instead of photointense rim and exaggerates the photopenic defect caused by nonvisualization of the gallbladder (4).

**FIGURE 2.** Rim sign (arrows) seen in early hepatic phase and persisting throughout study.



**FIGURE 3.** Persistent rim sign (arrows) but no gallbladder visualization at 1 hr.



A single case of a rim sign with normal visualization of the gallbladder has been reported by Thorstad et al. (8). The patient was found to have acute and chronic cholecystitis at surgery 4 days later. In another single case study, Lowry and Tran reported a rim sign with delayed gallbladder visualization (9). This patient's symptoms resolved without treatment.

Several points deserve emphasis:

1. A photointense rim sign can be missed when there is normal gallbladder function by DISIDA scanning because it is close to the target intensity of the functioning gallbladder.
2. In our patient, the rim sign was present early in the hepatic phase prior to filling of biliary radicals. It should be looked for during the early phase, since the more favorable target to background allows easier identification.
3. Our patient was immunocompromised and neutropenic when initially studied. Such patients may not have enough WBCs and secondary inflammatory cytokines to cause cystic duct obstruction until their WBCs begin to recover.

4. Whenever a rim sign is present, with or without gallbladder visualization, there should be a high index of suspicion for acute or subacute cholecystitis.

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