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4. You are shown images obtained with 99mTc-disofenin 
before and after administration of cholecystokinin (Fig. 5A) 
and a gallbladder emptying curve (Fig. 5B) from a patient 
with recurrent right upper quadrant pain and a normal 
sonogram of the gallbladder and bile ducts. The first image 
in this sequence was taken 60 minutes after injection of 99mTc-disofenin. Which one of the following is the 
best interpretation of this study?
   A. acute cholecystitis
   B. chronic acalculous cholecystitis
   C. sphincter of Oddi dyskinesia
   D. bile gastritis
   E. normal study

SELF-STUDY TEST
Gastrointestinal Nuclear Medicine

ITEMS 1 and 2: Bile Leak
ANSWERS: 1, D, 2, E.
Following blunt injury to the abdomen, there may be hepatic laceration 
or fracture, with resultant disruption of the biliary tree. Cholescintigraphy 
is a useful method of determining the presence of a biliary leak or 
formation of a bile cyst (biloma).
The images in Figure 1 show rapid uptake of the tracer by the liver. 
On the immediate postinjection image, the left lobe of the liver has patchy 
uptake and irregular margins. With time, a small "rubbing" of activity 
occurs in the central portion of the left lobe. These findings likely represent 
disruption (laceration) of the left lobe of the liver, with resultant 
separation of the left hepatic duct. Over time, the common bile duct is 
visualized, with free transit of the radiotracer into the duodenum. By 45 
minutes, the gallbladder is faintly visualized, and continues to accumulate 
the radiotracer thereafter. Therefore neither acute nor chronic cholecystitis 
is likely.
Immediately adjacent to the left lobe of the liver, a collection of activity 
is apparent at 30 minutes; this collection becomes more prominent over 
time, has a roughly triangular configuration, and persists on the 24-hour 
image (Fig. 2). This likely represents leakage of bile into the confines 
of the lesser sac. Since the majority of bile is draining into the small bowel, 
however, the patient can be managed conservatively and no specific 
therapy is necessary. Neither an intravenous cholangiogram or CT scan 
is needed, as the scintigraphic pattern is diagnostic of a bile leak.
While penetrating injury is usually managed by surgical intervention, 
blunt biliary trauma is managed conservatively, since initial hemorrhage 
is the main concern. In most individuals, disrupted bile ducts probably 
heal spontaneously, but some individuals will go on to form an enclosed 
bile cyst (or biloma). Formation of a bile cyst may be preceded by a latent 
period occurring after the initial injury, after which the individual gradually 
develops symptoms. Bile cysts usually involve the right lobe of the liver, 
and may be quite large, and may or may not communicate with the biliary tree. 
Following surgery, cholescintigraphy is particularly useful in determining 
that a patient's recurrent symptoms are due to bile leakage. A frequent 
cause of leakage is incomplete cystic duct ligation, and hence, the most 
common location of the bile collection is the gallbladder fossa, although 
a collection may form in any dependent portion of the peritoneal cavity. 
In such cases, delayed views are usually necessary to identify the bile

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REPLY: We wish to thank Drs. Grünwald and Biersack for their interest in our work. We certainly agree with the necessity of rigorous quality control in the preparation of $^{99m}$Tc-HMPAO. Due to the characteristics of the radiopharmaceutical, paper chromatography prior to injection is not practical. Their suggestion of simultaneous injections in two patients provides an elegant and definite proof of radiopharmaceutical quality. However, we do not believe that their technique would be applicable to the patients studied by our group. Our studies are usually performed as an urgent or semi-urgent procedure in the intensive care unit and it is doubtful that patients with neurologic disorders who would serve as controls would be available at the exact same time. We prefer to rely on the radionuclide angiogram of the head performed at the time of injection to quality assurance technique. This part of the study is not affected by radiopharmaceutical impurities. When there is no $^{99m}$Tc-HMPAO in the brain, one should always review the radionuclide angiogram before confirming the diagnosis of brain death. Chromatography is used to verify the quality of the product.

Our experience with $^{99m}$Tc-HMPAO in all applications includes quality assurance of about 2,000 vials. We find the preparation of the product to be reliable and reproducible, provided that there is adherence to protocols. We have never had to repeat a study for reasons of radiopharmaceutical quality deficiency.

REPLY: We read with interest the letter presented by Grünwald and Biersack. In fact, their procedure seems to be an elegant in vivo quality control method for the radiochemical purity of $^{99m}$Tc-HMPAO. Nevertheless, there are some misunderstandings. From an ethical point of view, the diagnosis of brain death should be independent from any other clinical requirement, such as patients with Alzheimer's disease. Furthermore, the in vivo quality control procedures recommended by us can only be regarded as additional controls. In our opinion, the in vitro methods, which can be easily performed within a few minutes, should be the basis of $^{99m}$Tc-HMPAO quality control, but not the subject of any discussions.

N.R. Laurin
A.A. Driedger
Victoria Hospital
London, Ontario, Canada

W. Brandau
O. Schober
Westfälische Wilhelms-Universität
Münster, Germany

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ANSWERS

leak, since images obtained within the first hour may appear completely normal. In patients with biliary-enteric anastomotic bypasses, cholecintigraphy is not only useful in determining the presence of a bile leak, but is superior to other methods (upper gastrointestinal series, T-tube cholangiograms) in determining the preferential route of biliary drainage.

References


ITEM 3: Sphincter of Oddi Dyskinesia

ANSWER: D

This patient's images (Figs. 3 and 4) demonstrate the typical cholecintigraphic changes of sphincter of Oddi dyskinesia. There is a delay in biliary-to-bowel transit, a normal maximal gallbladder ejection fraction response to secretin, and a paradoxical response (dilated common duct sign) of the sphincter of Oddi, itself, to CCK. In addition, administration of CCK induced the patient's typical pain. The patient does not have duodenogastric reflux demonstrated so the syndrome of alkaline reflux gastritis is unlikely to explain her symptoms. Since both her serum and urinary amylase are normal, she is not likely to have pancreatitis. Chronic acalculous cholecystitis and biliary infundibular cervicocystic dyskinesia (a synonym for cystic duct syndrome) are not likely diagnoses, because her maximal gallbladder ejection fraction response to CCK is normal (i.e., > 35%).


Reference


ITEM 4: CCK Cholecintigraphy in Chronic Acalculous Cholecystitis

ANSWER: B

In Figure 5A, there is activity seen in the left upper quadrant, but this is clearly in loops of small bowel and at no time before or after CCK administration does activity appear to fill the stomach. No significant emptying of the gallbladder is seen following CCK injection. The peak gallbladder ejection fraction at 20 minutes is 9% (Fig. 5B).

The finding in this study of a subnormal peak gallbladder ejection fraction response to CCK in a patient with recurrent right upper quadrant pain and a normal biliary sonogram makes chronic acalculous cholecystitis the most likely diagnosis. Acute cholecystitis is not likely since the gallbladder is well visualized by 60 minutes. Sphincter of Oddi dyskinesia is not a likely diagnosis because the CCK-cholecintigram demonstrates neither a delay in biliary-to-bowel transit nor a paradoxical response of the sphincter of Oddi to CCK.

Reference