# Biliary Scanning with Tc-99m Pyridoxylideneglutamate—The Effect of Food in Normal Subjects: Concise Communication

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***Technetium-99m pyridoxylideneglutamate biliary scans were performed in 19 normal subjects in both the fasted and nonfasted state. The effect of eating was to reduce visualization of the gallbladder from 100% (fasted) to 47% (nonfasted). The common bile duct was seen in 84% on both occasions but intrahepatic and cystic ducts were seen less frequently in the nonfasted group. Preparation of patients by fasting is essential if information concerning gallbladder function is sought.***

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The development of technetium-99m pyridoxylideneglutamate (Tc-PG) (*1,2*), has made biliary scanning routine in our laboratory. Although not an "instant kit" method, the preparation is simple, and continuing use has shown the technique to be of great value in the differential diagnosis of patients presenting with "surgical" jaundice (*3*).

It has been noted (*2,4*) that a proportion of normal subjects fail to show accumulation of radioactivity in the gallbladder. Before attributing this phenomenon to gallbladder disease in otherwise healthy individuals, we decided that further investigation of the parameters affecting the normal Tc-PG biliary scan was warranted, particularly with regard to food intake before scanning.

## METHODS

Nineteen normal volunteers without history of hepatobiliary disease gave informed consent for the study. Fourteen females and five males were included, with ages ranging from 21 to 50 yr. Each subject was injected intravenously with 1 mCi Tc-PG while lying supine under the scintillation camera and a series of 4-min exposures was commenced with the camera positioned over the liver and upper abdomen. This was continued for 1 hr, then lower abdomen and right lateral views were obtained. If no radioactivity was observed in the duodenum, a lower-abdominal view was taken 18 hr later.

Each subject was studied after a 4–6-hr fast and, on a separate occasion, within 1 hr of completing a "normal" meal containing meat, vegetables, and pastry. Each scan was assessed with reference to the appearance of the liver, bile ducts, gallbladder, and kidneys, and the time at which radioactivity was first observed in these organs and the duodenum was noted. Five subjects collected urine for the following 24 hr after injection and the proportion of Tc-99m PG excreted by this route was calculated by comparison with a standard identical to the administered dose.

## RESULTS AND DISCUSSION

Each of the 19 subjects studied showed good liver uptake of radioactivity by the end of the first 4 min, together with a rapid fall in blood background. Typically, in a fasted subject (Fig. 1) the gallbladder began to accumulate radioactivity by 8–12 min and the bile ducts were visible within 12–16 min. By 20 min the gallbladder showed intense uptake, and activity was generally observed in the duodenum within 30 min. After eating, in contrast (Fig. 2), this subject showed no trace of radioactivity in the gallbladder throughout the study.

The time of appearance of radioactivity in the organs of interest is shown in Table 1. There appears to be no significant difference between the fasted and nonfasted studies with regard to time of appearance in the bile ducts (usually the common bile duct). In five studies, four of which were from two patients, no bile duct could be identified even though liver uptake appeared normal.

As already mentioned, visualization of the gall-

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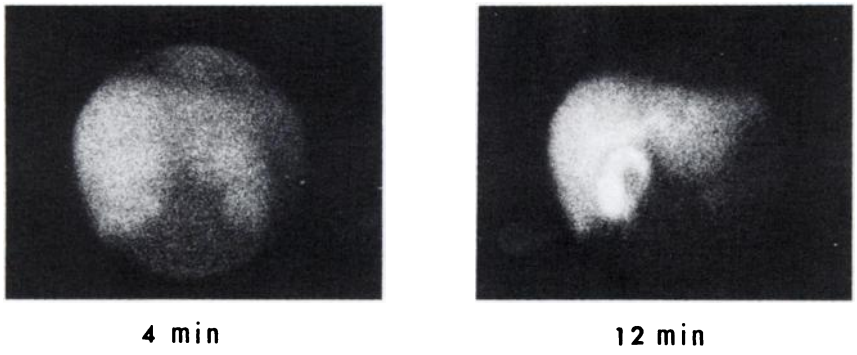


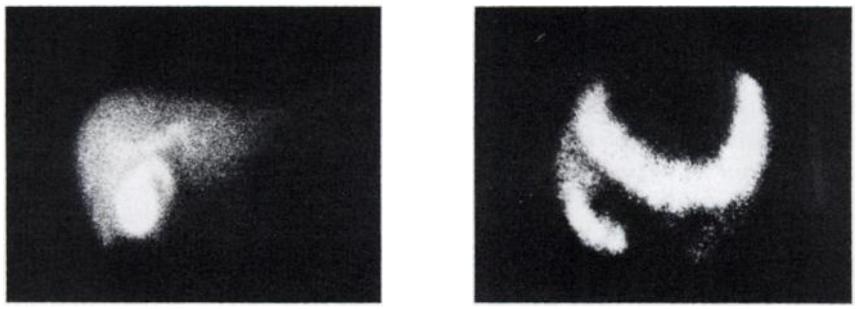
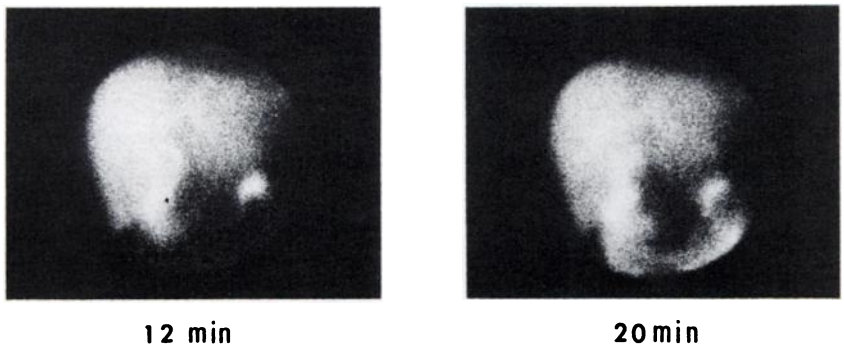




**FIG. 1.** Normal Tc-99m PG biliary image in fasted subject. Gallbladder accumulation is intense within 20 min.



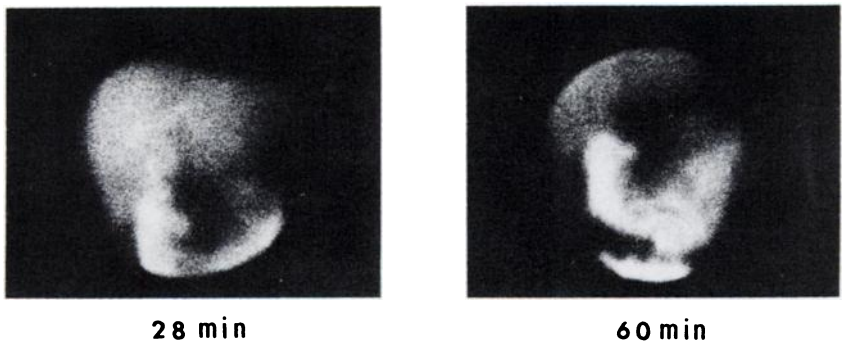




**FIG. 2.** Repeat scintiscans in subject of Fig. 1 within 1 hr of eating. Transient renal activity in early phases has almost cleared by 28 min. Gallbladder activity is not observed at any stage, and bile ducts are less distinct.

bladder was greatly enhanced by fasting prior to the study. In all of the fasting studies, the gallbladder was observed (Table 2), whereas it was not observed at all in 53% of the nonfasting studies (Table 1). Although 63% of gallbladders appeared within the first 16 min in fasted subjects, the timing in the remainder of this group was well spread out, with about 20% appearing after 30 min. This highlights the importance of continuing the study for a full 60 min if the gallbladder is not seen early. The majority of gallbladders that were observed after eating showed reduced uptake compared with the fasting study.

The time of appearance of radioactivity in the

**TABLE 1. TIME OF FIRST APPEARANCE OF RADIOACTIVITY DURING Tc-99m PG BILIARY SCAN**

| Time (min) | Bile ducts | | Gallbladder | | Duodenum | |
|---|---|---|---|---|---|---|
| | F | NF | F | NF | F | NF |
| 8 | — | 1 (5%) | 4 (21%) | — | — | — |
| 12 | 11 (58%) | 9 (47%) | 5 (26%) | 2 (11%) | — | 5 (26%) |
| 16 | 4 (21%) | 5 (26%) | 3 (16%) | 3 (16%) | 2 (11%) | 6 (32%) |
| 20 | 2 (11%) | 1 (5%) | — | — | 7 (37%) | 4 (21%) |
| 24 | — | — | 2 (11%) | — | 1 (5%) | 1 (5%) |
| 28 | — | — | 1 (5%) | 1 (5%) | 4 (21%) | 2 (11%) |
| 32 | — | — | 1 (5%) | — | 1 (5%) | — |
| 36 | — | — | 1 (5%) | 1 (5%) | — | 1 (5%) |
| 40–60 | — | — | 2 (11%) | 2 (11%) | 2 (11%) | — |
| 18 hr | — | — | — | — | 2 (11%) | — |
| Not seen | 2 (11%) | 3 (16%) | — | 10 (53%) | — | — |

Nineteen subjects studied.
F = fasted, NF = nonfasted.

**TABLE 2. FREQUENCY OF VISUALIZATION WITH Tc-99m PG BILIARY IMAGING ACCORDING TO FASTING STATE**

| | Bile ducts | | | |
|---|---|---|---|---|
| | Intra-hepatic | Cystic | Common | Gall-bladder |
| Fasted | 13 (68%) | 8 (42%) | 16 (84%) | 19 (100%) |
| Nonfasted | 7 (37%) | 2 (11%) | 16 (84%) | 9 (47%) |

**TABLE 3. URINARY EXCRETION OF Tc-99m PG IN FIVE NORMAL VOLUNTEERS**

| Hr | % Dose ± 1 s.d. |
|---|---|
| 0 – 1.5 | 26.6 ± 2.2 |
| 1.5– 3.0 | 6.0 ± 0.9 |
| 3.0–18 | 9.6 ± 5.5 |
| 18 –24 | 0.9 ± 0.6 |
| 0 –24 | 43.9 ± 4.3 |

duodenum was also affected by food. In the nonfasted subjects, 58% were observed to have radioactivity in the duodenum by 16 min but this was observed in only 11% of the fasted subjects. The majority of the latter group excreted tracer into the duodenum within the 20–30 min interval. The difference in tracer handling is undoubtedly due to the choleretic effect of food (*5*).

The anatomic visualization achieved by Tc PG biliary scanning is summarized in Table 2. The common bile duct was seen in 84% of studies, and this was not affected by the fasting state of the individual. Only about half the number of intrahepatic ducts were visualized after food, however, and observations of the cystic duct fell dramatically.

Table 3 shows the cumulative excretion of Tc-99m PG by the kidneys over a period of 24 hr. Although a significant proportion of the injected dose appeared in the urine, the kidneys were usually seen only transiently within the first 4–8 min. Exceptions were found when subjects abstained from both solid food and fluid, in which case renal calyceal activity persisted longer. Patients should therefore be adequately hydrated to facilitate identification of the gallbladder, which often appears close to the right kidney in the anterior view. In the right lateral view, however, these organs are easily distinguished.

Although the dose employed in this series was only 20% of that used in routine clinical studies, the Tc-99m PG scan provided remarkably clear images of the liver and biliary tract. Newer biliary agents such as Tc-99m HIDA (*6*) have less renal excretion, which should improve image quality. It is clear, however, that preparation of the patient by fasting is essential for reliable visualization of the gallbladder.

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