that the gallium activity was located near the stomach. After another glass of water was taken, the stomach was imaged again, using the upper three gallium peaks and thus excluding the Tc-99m energy. This showed that the gallium activity was no longer present in the stomach (Fig. 1). Gallium and Tc-99m were seen on the oscilloscope to enter the small bowel. An image taken 30 min later did not show any recurrent uptake in the stomach.

**Discussion.** Gallium is excreted through the intestinal wall of almost the entire gastrointestinal tract and in small amounts through the liver and biliary tract (5, 6). Orally administered Tc-99m has been used in our laboratory (7, 8) and in other nuclear medicine facilities (9), along with computer-assisted subtraction techniques (4), to help in recognizing this normal, intraluminal uptake. Secretion of gallium into the stomach is not recognized as a common excretory pathway (5, 6), and gallium is not observed in the stomach, even when scans are performed as early as 6 hr after administration of the dose.

Our patient had no clinical or laboratory evidence suggestive of gastric or proximal gastrointestinal disease. The uptake of gallium in the liver and its appearance in the lower intestinal tract were normal on scans.

Uptake of gallium in the stomach has been associated with diseases of the stomach, particularly gastric lymphoma. In these cases, however, gallium is considered to be localized intramurally within the pathologic lesion, and not intraluminally, as was true in our case.

Experience suggests that gallium rarely accumulates in the stomach. Such an accumulation may lead to a false diagnosis of a left subdiaphragmatic abscess or lymphoma of the stomach. We suggest that, before a left subdiaphragmatic accumulation of gallium is considered to represent an abscess or tumor, an image should be made after the ingestion of one or two glasses of water.

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**REFERENCES**


**The Validity of Performing a Ventilation Study after the Perfusion Lung Scan**

Coates and Garnet (1) suggest that there are problems when the ventilation lung scan using Xe-133 gas is performed after the perfusion scan because of Tc-99m scatter background in the 80-keV window of Xe-133. Cradduck and Driedger (2) feel this objection can be removed, in institutions where data processing is available, by the use of computer-assisted background subtraction. We disagree. Background subtraction is not necessary. The interpretation of Xe-133 ventilation studies following a perfusion scan suffers very little from the background of scattered Tc-99m photons.

In 23 consecutive cases of suspected pulmonary embolism, the diagnostic value of film was compared with that of computer-displayed images with and without technetium background subtraction. The perfusion image was obtained using 2 mCi of Tc-99m MAA. The ventilation study used a concentration of about 1.6 mCi of Xe-133 gas per liter.

Our experimental protocol was as follows:

1. For film:
   a) one perfusion image (maximum information density of 1000 counts/cm²),
   b) six ventilation images: first two of washin (ID of 1000), the third of equilibration (ID of 1000), and the last three of washout (1 min each).

2. For computer images (stored in a 64 x 64 matrix):
   a) one 2-min perfusion image;
   b) one 30-sec image of Tc-99m background in the Xe-133 window;
   c) eighteen images of 30 sec each during the ventilation phases of washin, equilibration, and washout.

The film and computer images were interpreted by one of us (RM). To reduce bias, each image modality was reviewed separately in a single session with a different sequence for each modality. To enhance computer analysis, macros were written, one with and one without background subtraction.

Table 1 summarizes our results. The diagnosis made from images on film, and on computer with background subtraction

<table>
<thead>
<tr>
<th>Comparison made</th>
<th>COLD + PE</th>
<th>COLD</th>
<th>PE</th>
</tr>
</thead>
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<tr>
<td>F - C</td>
<td>17 (74%)</td>
<td>19 (83%)</td>
<td>19 (83%)</td>
</tr>
<tr>
<td>F - CS</td>
<td>20 (87%)</td>
<td>21 (91%)</td>
<td>22 (96%)</td>
</tr>
<tr>
<td>G - C</td>
<td>18 (78%)</td>
<td>19 (83%)</td>
<td>20 (87%)</td>
</tr>
<tr>
<td>C - F</td>
<td>18 (78%)</td>
<td>19 (83%)</td>
<td>20 (87%)</td>
</tr>
<tr>
<td>C - F</td>
<td>14 (61%)</td>
<td>17 (74%)</td>
<td>18 (78%)</td>
</tr>
<tr>
<td>CS - F</td>
<td>16 (70%)</td>
<td>18 (78%)</td>
<td>19 (83%)</td>
</tr>
</tbody>
</table>

COLD = chronic obstructive lung disease. PE = pulmonary embolism. F = diagnosis made from film. C = diagnosis made from computer images without Tc-99m background subtraction. CS = diagnosis made from computer images with Tc-99m background subtraction. FD = final patient diagnosis.
LETTERS TO THE EDITOR

Disappearance of a Hyperfunctioning Thyroid Nodule

The case report by Kammer and Loveless (/), describing the disappearance of a hyperfunctioning thyroid adenoma following TSH stimulation, is of considerable interest. Recently we had the opportunity to evaluate and treat a patient with a toxic autonomous nodule that disappeared after 4 weeks of therapy with propylthiouracil (PTU). The 24-year-old patient was found to have a prominent thyroid by her general physician. She complained of frequent headaches of 2 months' duration, which had been relieved somewhat by antidepressant medication. She also noted hair loss, easy fatigability upon exertion, intolerance to heat, and increased nervousness.

On physical examination, the thyroid gland was generally enlarged to 1 1/2 times normal size, with a prominent 2-cm nodule palpable in the upper pole of the right lobe. The gland was slightly tender in both lobes, more so on the left. The remainder of the physical examination was essentially normal.

Laboratory tests showed a T4 RIA to be 8.6 μg/dl (normals 5.2-13.0 μg/dl), T3 uptake was 34.7% (normals 22-46%), free thyroxine index was 2.98 (normals 1.72-5.98), and the T3 RIA was 215 ng/dl (normals 110-190 ng/dl). The serum antithyroglobulin antibody was negative by indirect immunofluorescent staining procedure and by indirect hemagglutination test. The 24-hr thyroidal radioiodine uptake was 12%. The thyroid scan (see figure) confirmed the presence of a functioning 2-cm nodule in the upper pole of the right lobe. The nodule was hyperfunctioning relative to the remainder of the gland, which was functionally suppressed.

The patient was started on sodium salicylate because of the tenderness of the gland. Propylthiouracil (PTU) was started because of the clinical and laboratory findings of T3 thyrotoxicosis resulting from a toxic autonomous nodule. TSH stimulation and T3 suppression tests were not performed.

The patient was re-examined after 1 month of this therapy. The 2-cm nodule was completely nonpalpable. The overall size of the gland remained 1 1/2 times normal size to palpation, and was nontender. The patient had improved greatly symptomatically.

REFERENCES


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FIG. 1. Computer output from ventilation-perfusion study in patient with pulmonary embolism. Projection is posterior. (a) Two-minute perfusion image using technetium setting. (b) Thirty-second image, illustrating scattered Tc-99m photons accepted into Xe-133 window. (c) First 30 sec of washin of xenon. (d) Image (c) minus image (b).

(CS) and without (C) are shown. The numbers indicate those studies in which there was agreement in diagnosis. The table also shows the relationship of these three techniques to the final diagnosis (FD) made for the patient in each case. The final diagnosis made use of other information such as additional perfusion views, chest radiographs, and patient examination.

Film (F) relates best to final diagnosis (FD) because of its superior resolution over computer images. Diagnosis from computerized background-subtracted images (CS) was more closely related to the film diagnosis than the background-included images (C), but only modestly so. We believe this is because of the law governing Compton scatter (2). (The minimum energy of a singly scattered 140-keV photon still falls above the pulse-height window normally used for Xe-133.) This phenomenon is illustrated in Fig. 1. The image produced by the photons scattered from Tc-99m into the Xe-133 window (b) has little of the definition seen in the perfusion image (a). As a result, the first washin image with background subtraction (d) is similar to the first washin image without background subtraction (c), even though 49% of the counts in the first washin image are due to Tc-99m scattered photons. We submit that on film the trained eye can make adjustments for this kind of background.

Although the numbers presented are small, they support our opinion that Xe-133 ventilation studies performed after perfusion studies give a better indication of disease if recorded on film, rather than computer, even if the computer images are background-subtracted.

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