Case Reports

Gallium-Subtraction Technique for Tumor Localization

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A 56-year-old woman was admitted to the hospital for clinical evaluation of a large left upper quadrant (LUQ) abdominal mass. Her cervical nodes were found to be enlarged; a lymphoma was questioned. She complained of low back pain and left thigh pain.

A liver-spleen scan showed a liver normal in size, shape, and position. The spleen appeared to be mildly enlarged and showed no abnormal defects. A gallium scan of the neck and trunk, performed three days following the intravenous administration of 2-mCi Ga-67 citrate, showed localization in the cervical, left para-aortic, pelvic, and inguinal node regions (Fig. 1). Biopsy revealed diffuse histocytic lymphoma.

Nine months later the patient was again admitted to the hospital with chills and temperature of 102° F. She complained of low back pain radiating down her left leg as well as urinary retention. Repeat gallium scan of the entire trunk and node-bearing areas was performed two days following the intravenous administration of 2.5-mCi Ga-67 citrate. Intense focal gallium uptake in the LUQ was well visualized on both anterior and posterior images (Fig. 2).

The location of this large intense focal gallium uptake arises in which of the following?

1. Left lobe of the liver.
2. Splenic bed.
3. Left kidney.
4. Extrinsic to the above organs.

Figure 2 shows intense gallium uptake in a rather large area in the LUQ, which is well visualized on both the anterior and posterior views. This was seen previously but appears metabolically more active on this study. There is probable focal abnormality in the lower lumbar spine and perhaps in the sacrum that was not previously appreciated. In order to localize the abnormality in the LUQ, a dual-radionuclide study using Tc-99m sulfur colloid was performed.

Fifteen minutes before imaging, 0.5-mCi Tc-99m-sulfur colloid was administered to the patient. Both technetium and gallium images of anterior and posterior splenic area were obtained without moving the patient. Using the Ohio-Nuclear 150 Datasystem, each image was normalized to 100%. The technetium images were then

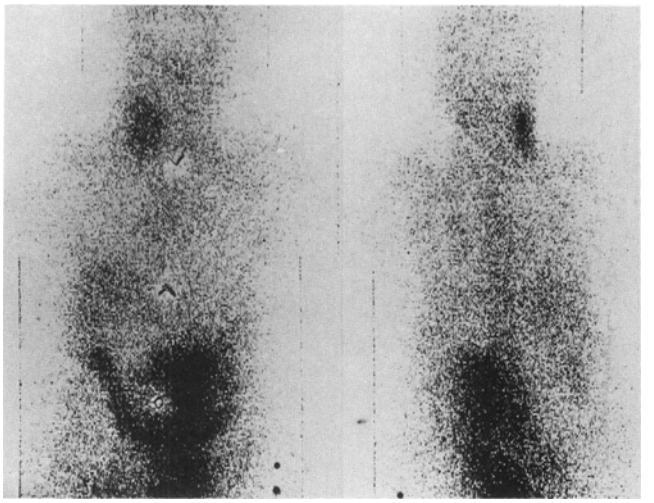

FIG. 1. Anterior and posterior gallium images show localization in cervical, left para-aortic, pelvic, and inguinal node regions.

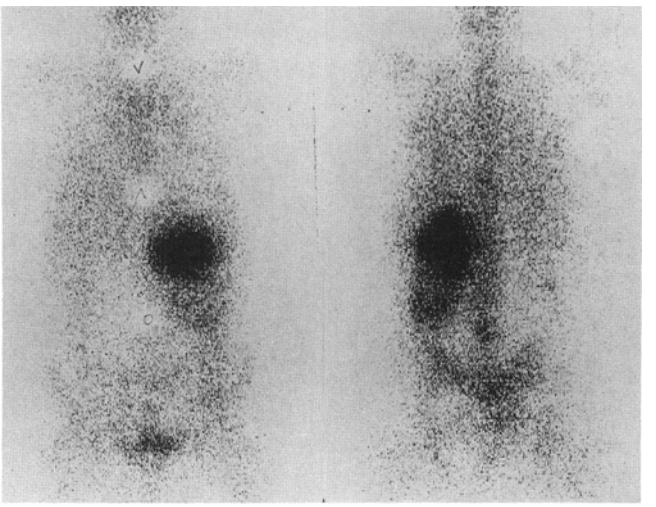

FIG. 2. Repeat gallium scan of same patient nine months later shows intense focal gallium uptake in left upper quadrant.

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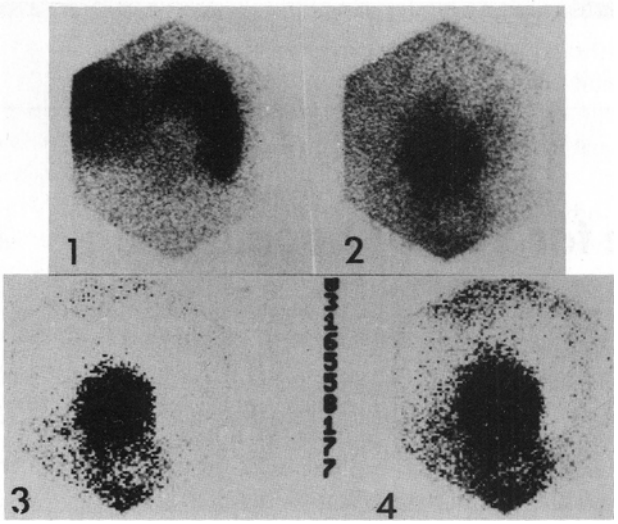

FIG. 3. Anterior gallium-spleen subtraction images: starting with upper left image and following left to right, images are anterior technetium, anterior gallium of same area, 100% technetium image subtracted from gallium image, and 50% subtraction.

arithmetically subtracted from each gallium image using weighting factors of 50% and 100%. At the conclusion of this procedure, the increased gallium area appeared to concentrate medially and inferior to the spleen. This procedure was essential in helping to exclude the possibility of any involvement of the left lobe of the liver and the spleen (Figs. 3 and 4).

In order to localize this active area further, gallium subtraction of the kidneys was performed the following day. Approximately ½ hr before imaging, the patient was injected with 4 mCi of Tc-99m-2, 3-dimercaptosuccinic acid (DMSA). Again without moving the patient, posterior technetium and gallium images of the kidneys were obtained favoring the patient's left side (Fig. 5).

A large area of gallium uptake was noted arising immediately anterior to the upper half of the left kidney, probably in the prerenal space with some projection inferiorly around the left kidney's inferior pole. No intrinsic lesion was identified in either spleen or kidney. This combined sutdy, i.e., both gallium-spleen and gallium-kidney subtractions, was helpful in localizing a large active inflammatory or lymphomatous mass arising in the prerenal space just anterior to the left kidney's upper pole. Therefore, no. 4 is the correct answer. Diagnostic possibility would include perinephric abscess.

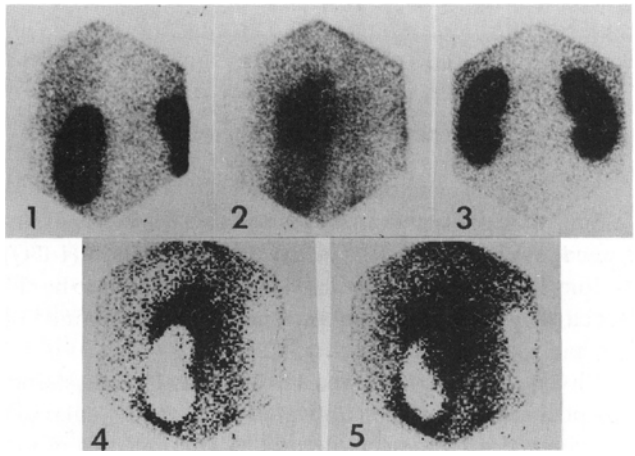

FIG. 4. Posterior gallium-spleen subtraction images: starting with upper left image and following left to right, images are posterior technetium, posterior gallium of same area, posterior gallium of lumbar spine, 100% technetium image subtracted from gallium image, and 50% subtraction.

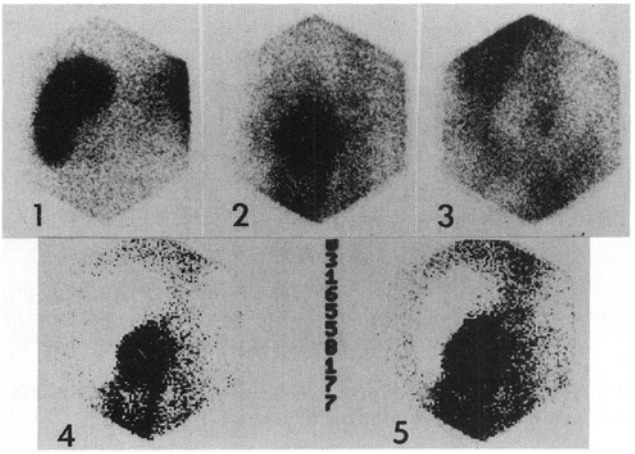

FIG. 5. Posterior gallium-kidney subtraction images: starting with upper left image and following left to right, images are posterior technetium, posterior technetium including both kidneys, 100% technetium subtraction, and 50% subtraction.

The usefulness of dual-radionuclide techniques has been well documented in the literature (*1-8*). At our institution we selectively use gallium-subtraction techniques to localize clearly abnormal areas, confirm suspicious regions, and identify previously undetected regions or areas. We most frequently use the gallium-subtraction technique for localization purposes because gallium accumulates in areas where technetium is not fixed and at times it is difficult to recognize the location and size of the lesion from either scan alone. In conclusion, the gallium-subtraction technique is useful in accentuating the target-to-nontarget ratio that emphasizes gallium activity in a specific region.

References

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