

SEPARATION OF LUNG-LIVER SCINTIPHOTOS DUE TO ASCITES—A FALSE POSITIVE TEST FOR SUBDIAPHRAGMATIC ABSCESS

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Combined lung and liver imaging with ^{131}I -labeled macroaggregated albumin (MAA) and ^{198}Au -colloid for the detection of subdiaphragmatic abscess was reported by Brown in 1965 (1), and the ability to detect subdiaphragmatic abscess is well demonstrated (2).

The use of $^{99\text{m}}\text{Tc}$ -colloid has improved the counting rate in liver imaging and the combination of $^{99\text{m}}\text{Tc}$ -colloid and ^{131}I -MAA has given satisfactory results. Because of wide energy differences, best results are obtained by imaging each isotope at its proper window setting without changing the patient's position (3).

Transmission imaging has been shown useful in anatomic orientation and as an assistance in interpretation of emission scans (4,5). More recently, a combination of transmission lung imaging and emission liver imaging was used for subphrenic abscess detection (6). When an abscess is present, the lung-liver interface is separated. The finding of image separation in conditions other than abscess prompted this study to evaluate lung-liver imaging in patients with ascites.

MATERIALS AND METHODS

Lung transmission imaging was done with 20 mCi of $^{99\text{m}}\text{Tc}$ in a 16×16 -in. water-filled source. Liver and spleen imaging was done with 3 mCi of $^{99\text{m}}\text{Tc}$ -sulfur colloid. Twenty nonascitic controls and five patients with ascites were randomly selected from routine requests for liver or lung-liver imaging. Ascites was diagnosed on the basis of physical examination, including abdominal fullness, fluid wave, and shifting dullness. All cases of ascites were associated with cirrhosis of the liver.

All studies were done on a Nuclear-Chicago Pho/Gamma H.P. camera with a high-resolution collimator. The anterior lung-liver image was obtained with 500,000 counts and the lung-spleen image with 300,000 counts.

RESULTS

The results are summarized in Table 1. Complete separation of the lung-liver image was observed in all cases of ascites and in none of the controls. The scintiphotos of the five patients with ascites and five controls are shown in Fig. 1. In one mildly obese patient without physical sign of ascites, separation of the lung-liver image and also the lung-spleen image was seen (Figs. 1B and 2B). Review of his medical record revealed impaired liver function and x-ray-proven esophageal varices. Ascitic fluid was first found during an elective inguinal herniorrhaphy about 1 month before the imaging. Therefore this case is classified in the ascites group, even though ascites was not physically demonstrated before imaging.

Separation of the lung-spleen image was also observed in all patients with ascites (Fig. 2). However, separation was also noted in three of the 20 controls or 15% (Figs. 2H, 2I, and 2J). To evaluate whether this might be a false positive due to the spleen being displaced from the dome of the diaphragm, Patient H was restudied with the camera tilted 25 deg downward (Fig. 3). The lung-spleen separation was not seen after this maneuver.

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	Lung-liver image		Lung-spleen image	
	Separated	Not separated	Separated	Not separated
Ascites	5	0	5	0
Control	0	20	3	17

DISCUSSIONS

Those conditions causing separation in lung-liver images include subdiaphragmatic abscess, pneumonic consolidation of the lower lobe of right lung, loculated infra-pulmonary effusion (1), diaphragmatic tumor, and, as shown in this study, ascites. In addition to

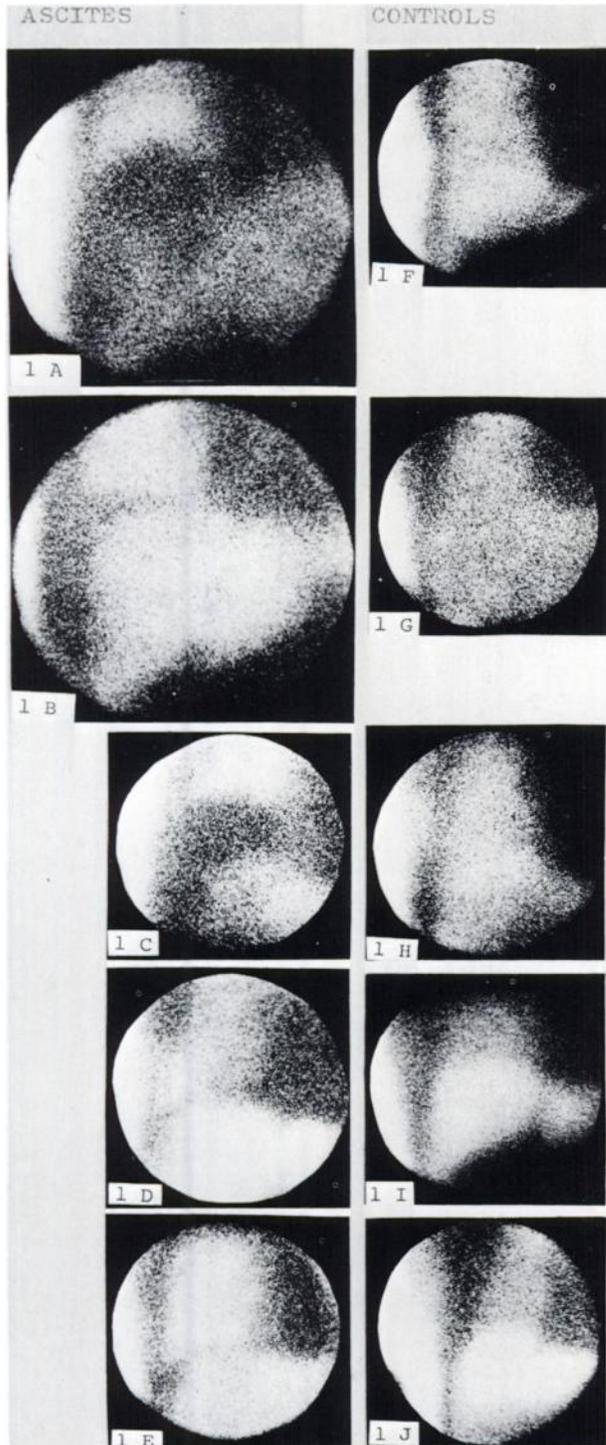


FIG. 1. Lung-liver images of five patients with ascites (A-E) and five controls (F-J). Separation of lung and liver is seen in all cases of ascites and none of controls.

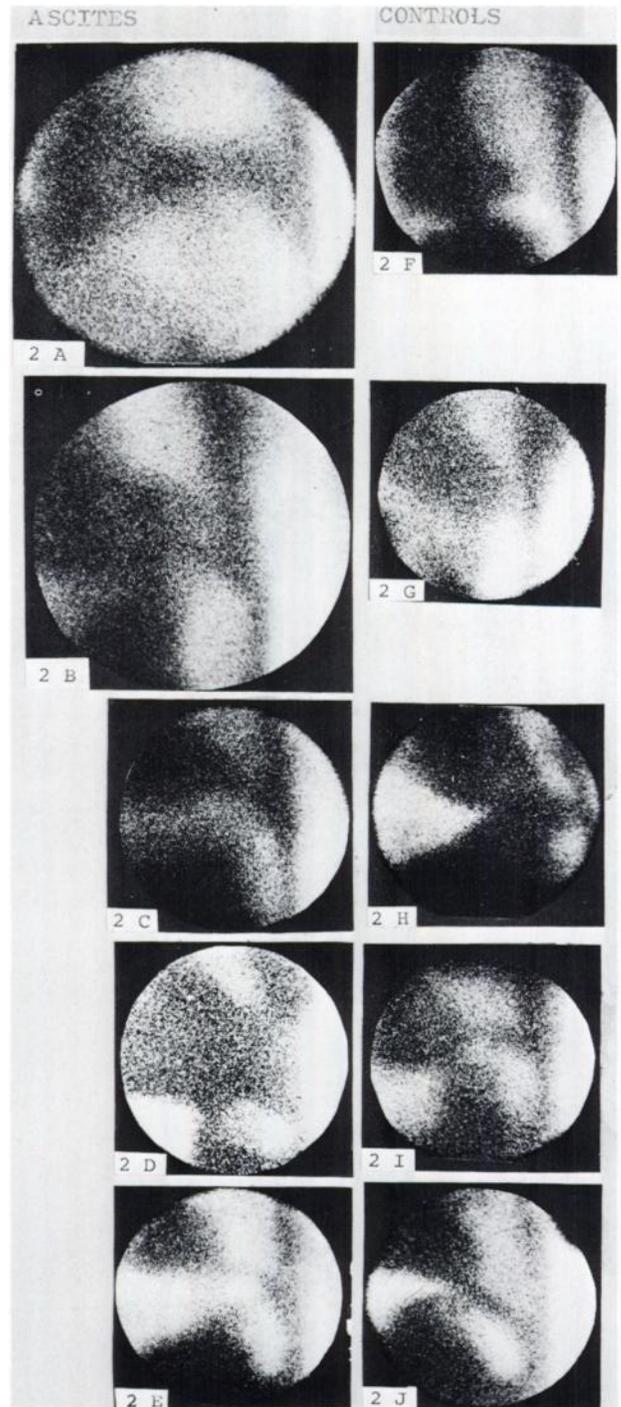


FIG. 2. Lung-spleen images in same cases as Fig. 1. Ascites (A-E) and controls (F-J). Separation of lung and spleen is seen in all cases of ascites and three controls (H, I, J).

causing lung-liver separation, subdiaphragmatic abscess also displaces the liver medially (6,7), and so does ascites (8). In the patient with subdiaphragmatic abscess, the dome shape of the diaphragmatic surface of the liver is lost (1), but in the patient with cirrhosis and ascites, the activity in the dome region may also be decreased (Fig. 1A).

The separation of lung-liver and lung-spleen images in patients with ascites may be due to the actual presence of fluid between the two organs. The separation of the lung-spleen image in the control group may be due to the posteriorly located spleen with the upper pole away from the superiorly located dome of the left hemi-diaphragm in the anterior view. Therefore, it may be possible to align the spleen pole and diaphragmatic dome by tilting the detector as shown in Fig. 3.

In this study, all patients with ascites had separation of both the lung-liver and the lung-spleen images. But in the control group, no lung-liver separation was observed. Only three out of 20, or 15%, of the control group had lung-spleen separation in the anterior view.

When a lung-liver separation is seen, lung-spleen imaging should be done. If the lung-spleen image is not separated, ascites may be excluded from the differential diagnosis of subdiaphragmatic abscess. But if both the lung-liver and the lung-spleen images are separated, ascites is the most likely cause, even though ascites is not physically demonstrated. If the anterior image shows lung-spleen separation without lung-liver separation, left subdiaphragmatic abscess should be considered, but a false-positive image separation may occur. Oblique positioning of the detector may be helpful.

SUMMARY

Combination of transmission lung imaging and emission liver and spleen imaging was done in five cases with ascites and 20 nonascites controls. All patients with ascites showed lung-liver and lung-spleen image separation. In the control group, no lung-liver image separation was observed; however, lung-spleen image separation was observed in three cases. Therefore, when a lung-liver separation is seen, the lung-spleen imaging should be done. If the lung-spleen image is not separated, subdiaphragmatic abscess should be considered. But if the lung-spleen is also separated, ascites is the most likely cause. Lung-spleen image separation alone may be a false-positive finding without ascites.

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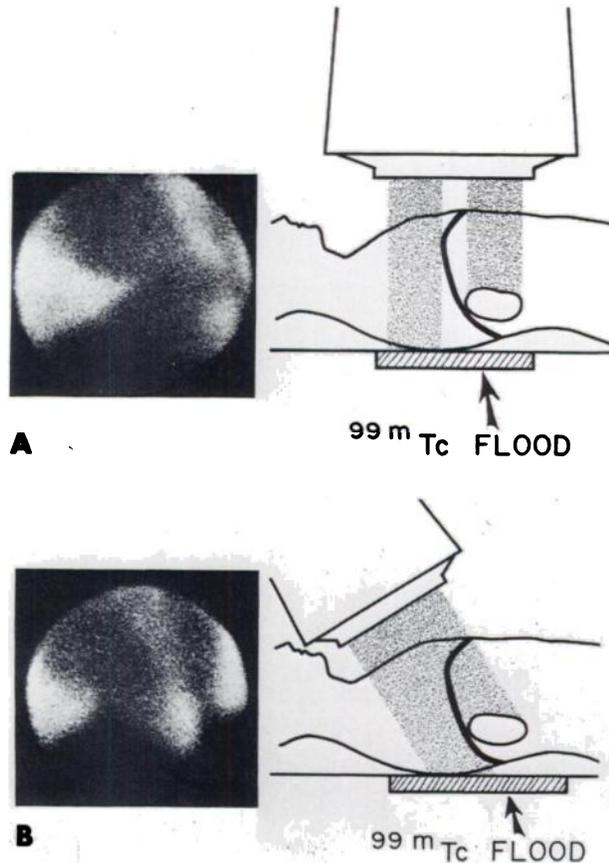


FIG. 3. A is anterior view of combined transmission lung image and spleen image. Note separation. In B detector was tilted 25 deg toward patient's head. Note merging of lung and spleen images.

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