THE PERIHEPATIC HALO IN LIVER SCINTIANGIOGRAPHIC PERFUSION STUDIES: A SIGN OF ASCITES

A. J. Alter and P. A. Farrer

McGill University and Royal Victoria Hospital, Montreal, Québec

Three cases of massive ascites are presented in which a halo was observed around the liver on hepatic perfusion studies with ^{99m}Tc-pertechnetate. The cause, significance, and value of this finding are briefly discussed.

Technetium-99m-pertechnetate rapid-sequence scintiangiographic liver perfusion studies of three patients with massive ascites showed the liver to be surrounded by a margin of reduced activity. The outer limit of this margin was delineated by the visceral and abdominal wall blood-pool activity giving the impression of a halo around the liver. Although ascites is fairly common among patients undergoing perfusion studies of the liver, this phenomenon has not to our knowledge been previously reported.

MATERIALS AND METHODS

The three patients reported all had clinically apparent ascites related to diverse causes. The ascites was readily demonstrable by physical examination and confirmed by abdominal paracentesis in all cases.

Rapid sequential liver scintiangiographic imaging was performed in a method similar to that of Freeman and Mandell (*1*). Patients were placed supine under a Pho/Gamma III scintillation camera, Model 6403 (Nuclear-Chicago Corp., Des Plaines, Ill.) with a diverging collimator. The patients had all had ^{99m}Tc-sulfur colloid liver scans 24 hr previously so that sufficient hepatic activity remained to permit proper positioning before the dynamic study. Following bolus intravenous injection of 10 mCi ^{99m}Tc-pertechnetate, 20-sec Polaroid exposures were obtained up to 160 sec. Immediately thereafter, a single cumulative 400,000-count exposure was obtained during the interval from 3 to 5 min after injection. Selected views from a normal study are presented in Fig. 1. In the 80–100 sec postinjection scintiphoto (Fig. 1A), the liver is well outlined and its borders are contiguous with the right lateral abdominal wall and only minimally separated from the cardiac and pulmonary blood pools. Activity can also be seen in the stomach and abdominal aorta. In the 3–5 min postinjection 400,000-count image (Fig. 1B), the left lobe of liver is seen to be contiguous with $^{99m}TcO_4$ activity in the gastric mucosa.

CASE REPORTS

CW is a 67-year-old male with a history of prolonged excessive alcohol intake who presented with anemia and progressively increasing dependent edema and ascites. Three days after liver perfusion study (Fig. 2), the patient underwent a needle biopsy of the liver which showed chronic, active alcoholic hepatitis and nutritional cirrhosis. Hepatic clearance studies with ^{198}Au-colloidal gold and ^{131}I-rose bengal confirmed a fairly severe degree of chronic cirrhosis and portal hypertension. The scintiangiographic hepatic perfusion study of the patient is shown in Fig.

Received Sept. 6, 1973; revision accepted Dec. 26, 1973.

For reprints contact: P. A. Farrer, Dept. of Nuclear Medicine, Royal Victoria Hospital, 687 Pine Avenue W., Montreal 112, Québec.

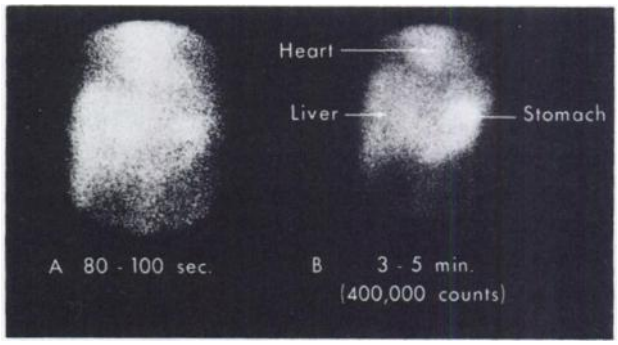

FIG. 1. Normal liver perfusion study, anterior views. (A) 80–100 sec postinjection. (B) postsequential 400,000-count, 3–5 min postinjection. This liver perfusion study of patient without ascites incidentally reveals Riedel's lobe. Arrow at 4 o'clock indicates activity in gastric mucosa which is contiguous with left lobe of liver. Note normally observed slight separation of cardiac and hepatic pools of activity.

2. Both the 120–140-sec and 3–5-min postinjection views demonstrate a definite halo about the liver extending into both flanks and causing a wide separation between the liver, the lateral abdominal wall, and the pulmonary and cardiac blood pools. The stomach is also separated from the left lobe of liver by a clear zone. The presence of ascites was confirmed by abdominal paracentesis.

MW is a 68-year-old female with hypercoagulable state of unknown etiology who has suffered repeated venous thromboses for 7 years involving renal, mesenteric, and peripheral veins. At the time of the present study (Fig. 3), she was hospitalized for progressively increasing anasarca and abdominal girth. The liver perfusion study of this patient depicted in Fig. 3 reveals a perihepatic halo with particularly wide separation of the liver from the right abdominal wall. Gastric mucosal radiopertechnetate activity is also widely separated from the left hepatic lobe. The presence of massive ascites was confirmed by abdominal paracentesis and the clinical diagnosis of portal vein thrombosis was supported by observation of diminished hepatic clearance of ^{198}Au-colloidal gold.

HD, a previously healthy 63-year-old female, presented with a 3-week history of anorexia, weight loss, and jaundice without known exposure to viral hepatitis or to hepatoxins. While hospitalized, she developed massive ascites and during this time a liver perfusion study was performed (Fig. 4). The latter shows a distinct halo around the liver with separation of the gastric activity from the left lobe by a clear zone. A week later she underwent a diagnostic laparotomy during which 2 liters of ascitic fluid were removed from the abdominal cavity. The liver biopsy done at that time showed toxic hepatitis.

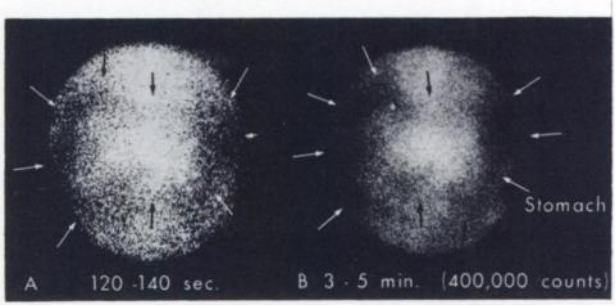

FIG. 2. Liver perfusion study of CW, patient with ascites, anterior views. (A) 120–140 sec postinjection. (B) postsequential 400,000-count, 3–5 min postinjection. Both views demonstrate definite halo about liver extending into both flanks as delineated by arrows. Note here that stomach (arrow) is separated from hepatic activity by clear zone.

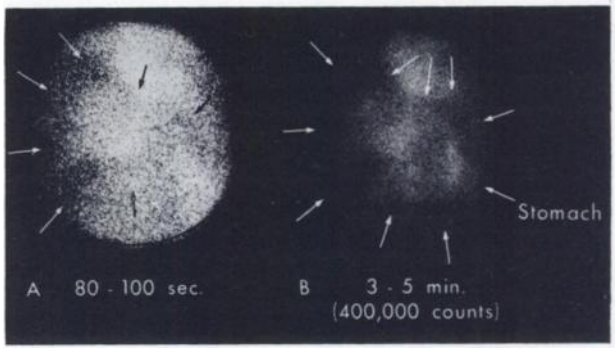

FIG. 3. Liver perfusion study of MW, patient with ascites, anterior views. (A) 80–100 sec postinjection. (B) postsequential 400,000-count, 3–5 min exposure. Arrows outline halo about liver. There is particularly wide separation of liver from right abdominal wall in patient. Again note gastric activity between 3 and 6 o'clock and its separation from liver.

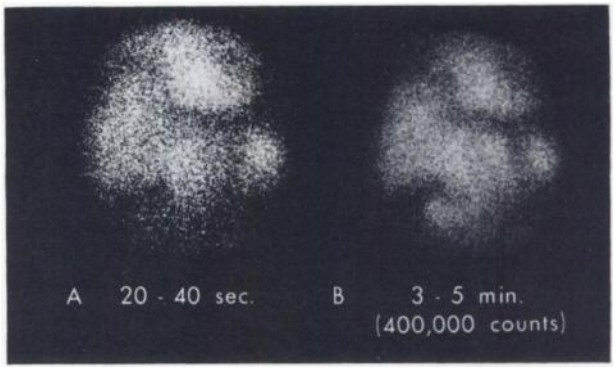

FIG. 4. Liver perfusion study of HD, patient with ascites, anterior views. (A) 20–40 sec postinjection. (B) postsequential 400,000 count, 3–5 min postinjection. Distinct halo is seen outlining liver. Gastric activity (noted between 3 and 4 o'clock) is separated from left lobe of liver by clear zone.

DISCUSSION

In their paper on scintillation scanning of the liver, Bonte, et al (*2*) noted that in the presence of ascites the liver may "float" away from the right lateral body wall and often may lie in the upper abdominal midline. Of course, in delayed scans following administration of radiocolloids, the position of the lateral body wall cannot easily be discerned without a marker and no organs other than spleen and occasionally bone marrow show activity. We are inclined to ascribe the halo surrounding the liver to four factors: (A) the tendency for the liver to float to the highest point within the ascites-filled abdomen limited in extent of motion by the hepatic ligaments; (B) the presence of a layer of fluid surrounding the liver and separating it from the abdominal wall; (C) significant radioactivity within the circulating blood pool which outlines the flanks, lungs, heart, and abdominal viscera; and (D) the usual pertechnetate uptake by gastric mucosa. It is evident from the foregoing that the hepatic halo is seen only with the patient supine and the detector above the abdomen.

The importance of the signs of ascites on liver scan has in general been minimized (*3*) since the magnitude of ascites is usually so great as to be

clinically obvious. Occasionally, however, a patient may present in whom the diagnosis is not readily apparent because of obesity or in whom a fluid-filled viscus or cyst is mistaken for true ascites or vice versa. In such cases the presence or absence of the hepatic halo sign may be of value in making the correct diagnosis.

In addition, the observation of a halo completely surrounding the liver may prevent a lung-liver or heart-liver separation from being erroneously attributed to a localized collection of fluid or pus. Yeh, et al (*4*) reported that ascites may cause a "false-positive" separation of lung and liver on combined liver-lung scans for the detection of subdiaphragmatic abscess. The presence of ascites can mimic a pericardial halo on blood pool scanning by causing a separation or hiatus which is greater than normal between the cardiac, hepatic, and splenic blood pools. Again, the demonstration of a complete perihepatic halo may help establish ascites as the true cause.

In the present discussion we have indicated that the perihepatic halo may be seen in the presence of serous ascites. However, it could as well be caused by any free fluid within the peritoneal cavity such as blood, chyle, or any transudate or exudate.

REFERENCES

1. FREEMAN LM, MANDELL CH: Dynamic vascular scintiphotography of the liver. *Semin Nucl Med* 2: 133–138, 1972

2. BONTE FJ, KROHMER JS, ELMENDORF E, et al: Scintillation scanning of the liver. II. Clinical applications. *Am J Roentgenol Radium Ther Nucl Med* 88: 275–288, 1962

3. CHRISTIE JH, MACINTYRE WJ, CRESPO GG, et al: Radioisotope scanning in hepatic cirrhosis. *Radiology* 81: 455–469, 1964

4. YEH E-L, RUETZ PP, MEADE RC: Separation of lung-liver scintiphotos due to ascites—A false-positive test for subdiaphragmatic abscess. *J Nucl Med* 13: 249–251, 1972