99m-Technetium-phytate Scanning in the Diagnosis of Hepatic Hydrothorax

S T PLUMMER, N POPAT, N BHAMBURE, G H TILVE, S R NAIK

Departments of Gastroenterology and Nuclear Medicine, Seth G S Medical College and K E M Hospital, Pune,Bombay 400 042.

Abstract
Transdiaphragmatic passage of ascitic fluid into the pleural space was demonstrated by injecting 3 mCi of 99m-technetium-phytate intraperitoneally in 6 cirrhotic patients with ascites and pleural effusion. In controls (8 patients with only ascites, 5 with only pleural effusion and 2 with neither), no migration of radioisotope from the peritoneal to pleural space occurred. 99m-technetium-phytate scanning is a rapid and effective method to demonstrate the ascitic origin of hepatic hydrothorax.

Key words: Cirrhosis, pleural effusion, ascites, radioisotope scanning.

Introduction
The incidence of pleural effusion in a cirrhotic patient in the absence of primary cardiac or pulmonary disease (the so called hepatic hydrothorax) has been variably reported to be between 0-4.6% and 10-5%. Dyes, 15Xe air, 133Xe air, and radioisotopes have been used to demonstrate the transdiaphragmatic passage of ascitic fluid into the pleural space. In the present study, we have used intraperitoneally instilled 99m-technetium-phytate to demonstrate the hepatic genesis of hydrothorax.

Material and Methods
Patients: Four groups of patients were studied. Group I consisted of 6 cirrhotics (3 males, 1 female; age range 21-55 years) with both ascites and pleural effusion. The diagnosis of cirrhosis was based on clinical findings, abnormal liver function tests, redistribution of isotope on hepatic scintiscan and endoscopic visualization of oesophageal varices in all patients. In addition, liver biopsy was done in 4 cases; two cases each revealed micronodular and mixed nodular cirrhosis. Ascites was present clinically and was confirmed by paracentesis; pleural effusion (3 left, 3 right) was confirmed by chest radiograph and paracentesis. The ascitic fluid analyses in all 6 patients revealed a transudate (protein 0-1-1.1 g/dl, cells 0-14/microlitre, culture sterile).

Group II comprised of 8 patients (6 males, 2 females; age range 25-50 years) with ascites but without pleural effusion. Six had cirrhosis (4 alcoholic, 2 posthepatic, diagnosed as in group I with biopsy proof in 1), 1 had chronic active hepatitis (on biopsy) and 1 Budd-Chiari syndrome (on IVC gram). The ascites was transudative in all cases (protein 0-1-1.4 g/dl, cells 0-20/microlitre, culture sterile).

Group III included 5 patients (1 male, 4 females; age range 35-45 years) with pleural effusion only (4 left 1 right). Four of the effusions were presumably tuberculous exudates (protein 3-4-4 6 g/dl, cells 450-770/microlitre with 70%-90% lymphocytes, culture sterile) and responded to antitubercular therapy. The fifth effusion was a result of acute pancreatitis (protein 3-7 g/dl, amylase 1100 Somogyi units). Ultrasonography did not reveal ascites in any patient in this group.

Group IV consisted of 2 patients (both males, 44 and 45 years)—one with isoniazid hepatitis and the second with vertebral tuberculosis. They had neither pleural effusion (on chest radiograph) nor ascites (on ultrasonography).

Method: Three mCi of 99m-technetium-phytate was injected into the peritoneal cavity. Simultaneous activity scans (Gamma Camera Dyna-IV) of peritoneal and pleural cavities were obtained immediately after injection and every 30 min for 3 hours and at 24 hours. In one alcoholic cirrhotic with ascites and right pleural effusion and in two patients with tuberculous pleural effusion (1 right, 1 left), the study was repeated after 48 hours with injection of the radionuclide into the pleural cavity to see if there was downward flow.

Results
In all group I patients (cirrhosis with ascites and pleural effusion), radioisotope injection into the pleural cavity appeared in the pleural cavity (Fig). In 3 of 6 patients this was evident by 1 hour (range 30 min to 1 h). In 2 of 6 patients this was evident by 2 hours.
to 2 hours). In the remaining 3 groups, the radioactivity did not appear in the pleural cavity even after 24 hours. In the 3 patients in whom the injection was made into the pleural cavity, there was no migration of radioactivity into the peritoneal cavity.

Discussion

Using 99m-technetium-phosphate scanning we demonstrated the ascitic origin of hepatic hydrothorax in all 6 patients with cirrhosis. In the controls (groups II, III and IV), the radioisotope remained confined to the peritoneal cavity.

Hepatic hydrothorax is usually right sided but may be left sided or bilateral. It may occur even in the absence of clinical ascites. The mechanism by which pleural effusion develops in a patient with ascites has been a matter of considerable dispute. Some have postulated that the peritoneal fluid is transported to the pleural space through diaphragmatic leaks. On the other hand, several authors have believed that the pathogenesis of hepatic hydrothorax involves microscopic or macroscopic diaphragmatic defects which may be congenital or acquired. The proposed sequence is as follows: The peritoneum extravasates through the defect and forms a bleb; rupture of this bleb results in a communication between the peritoneal and pleural cavities and migration of fluid into the pleural space is facilitated by the suction effect created by respiratory movements.

We demonstrated that radiouclide injected into the pleural space of cirrhotic patients with right pleural effusion and ascites did not migrate downward. This supports the contention that movement of fluid is unidirectional—from the peritoneal to the pleural cavity.

In one patient with hepatic hydrothorax, Johnston and Loo could demonstrate unidirectional flow of fluid using India ink and radio-iodinated serum albumin; carbon dioxide insufflated into the peritoneal cavity, however, failed to reach the pleural space. In another series, transdiaphragmatic passage of ascitic fluid was demonstrated using 11H labelled albumin, but air insufflated intraperitoneally reached the pleural space in only 5 of 9 patients and that too after as long as 48 hours. With the patients maintained in the sitting posture during this period to ensure the presence of air under the diaphragm. Such precautions are not necessary if 99m-technetium-phosphate scanning is used. This is not only a rapid procedure but appears to be safe and sensitive. This method could also be used for study in other conditions with simultaneous occurrence of ascites and pleural effusion.

References