Combined Liver-Lung Gamma Imaging in Subphrenic Abscess

D. O. KATZMAN

SUMMARY

Combined scintigraphy of the lung and liver provides a sensitive, simple and non-invasive method of evaluating the subphrenic space. Since the surgical approach is different in subphrenic, subhepatic and intrahepatic abscesses, accurate localisation and recognition of single or multiple abscesses provides the basis for an operative approach which may avoid unnecessary violation and contamination of the peritoneal cavity. The importance of correlation of the scintiscans with companion roentgenograms of the abdomen and chest, and accurate localisation of the diaphragm using serial scanning, is emphasised. Negative good-quality scans reliably rule out subphrenic abscess.


Although it has been more than 10 years since Brown et al., introduced the use of radionucleides in evaluating the subphrenic space, no report on the diagnostic value of combined scintiscans of the liver and lungs can be found in the South African medical literature. For this reason, an illustrative case is reported in order to draw attention to the value of this non-invasive method. The accuracy in detection of subphrenic abscess is reported to be in the vicinity of 98%, with no false negative studies.

PRINCIPLE

Simultaneous scintigraphy of the liver and lungs is performed after the administration of two radiopharmaceuticals, one for the visualisation of the liver and another for the lungs.

Localisation of radionucleides in the lung is achieved by means of capillary blockade, i.e. the radionuclide is 'tagged' to a particle which causes embolisation of the pulmonary capillary bed while localisation in the liver is achieved by means of phagocytosis, i.e. the isotope is 'tagged' to a colloidal particle which is immediately phagocytosed by the reticulo-endothelial cells of the liver. The tagged radioactive compounds used in simultaneous scanning must contain the same radionuclide or radionuclides, of similar gamma energy, so that they may easily be encompassed in the same window setting of the gamma spectrometer. To achieve optimal counting statistics, an information density of 800 (counts per cm² of the area scanned) must be used.

THE NORMAL LIVER-LUNG SCAN

Anterior, posterior and right lateral scans which include both the liver and the lungs, are performed. Normally, the lower portion of the right lung blends imperceptibly with the upper portion of the liver on both frontal and lateral projections so that there is continuity of both the intensity of radioactivity and the right lateral border of the scan (Fig. 2).

Two normal variants are occasionally seen on the anterior and posterior views, viz. a shallow indentation at the junction of the lung base and the superior hepatic margin, and a very thin, uniform arched line at the level of the diaphragm.

Position of the Diaphragm

In the absence of the thin arched line described above, the exact position of the diaphragm in the combined lung-liver scan is difficult to establish. To overcome this we have modified the technique as follows: a routine liver scan is performed first (Fig. 1). Meticulous attention is paid to the establishment of landmarks on the patient (umbilicus, xiphisternum, anterior superior iliac spine, etc.). This scan is then immediately followed by injection of the radionuclide for visualisation of the lung and the combined lung-liver scan is then performed in the usual manner, using the same surface landmarks. Superimposition of the first scan on the second scan allows accurate localisation of the liver-lung interface (Fig. 2). These scans are correlated closely with companion roentgenograms of the chest and abdomen, exposed in positions which simulate as closely as possible the position of the patient during the scintiscanning procedure.

THE ABNORMAL LUNG-LIVER SCAN

Separation of liver and lung radioactivity, i.e. a 'cold' area, confirms the presence of a space-occupying mass (Fig. 3). The nature of the mass is indeterminate on the scan and the many possible causes ('blood, pus, bile, chyle', pleural effusion, ascites, liver neoplasm, etc.) must be evaluated in the total clinical context. Special attention must be paid to the contour of the superior and lateral liver margins, which is often the principal differentiating point between a defect due to pleural effusion and a subphrenic lesion. The dome-shaped configuration of the liver is not disturbed by pleural effusion but is lost in a subdiaphragmatic abscess. A preliminary report by Beihn et al. suggests that combined scanning with Ga-citrate and Tc, with subtraction techniques, will differentiate between an abscess and the other causes of a subphrenic space-occupying lesion.

A left subphrenic lesion may be suspected when the combination scan shows separation between the spleen and...
**CASE REPORT**

A 72-year-old White diabetic woman presented with a 1-day history of pyrexia, vomiting and diarrhoea. Ten years earlier, after an episode of jaundice, a laparotomy had revealed a 'hard head of the pancreas' for which a Whipple's operation was performed. This was followed by considerable postoperative morbidity, including a draining sinus which eventually healed.

On examination the patient was found to be dehydrated. The chest and abdomen were normal. A catheter specimen of urine showed pyuria with a heavy growth of coliform bacteria; this responded well to antibiotic therapy, but recurred intermittently for the duration of the illness. An intravenous pyelogram was normal. Two blood cultures were negative. Episodes of confusion, persistent neutrophilia, fever, a rising ESR (up to 129 mm/h) and anaemia could not be satisfactorily explained. The patient responded to antibiotic therapy but approximately 1 month after the onset of her illness, the SGOT, bilirubin and alkaline phosphatase levels were significantly elevated. Pneumonia
Fig. 3. Anterior and right lateral combined liver-lung scans. There is a 6 × 5-cm, well-circumscribed 'cold' area in the right posterior subphrenic space (straight arrows), and a large anterior perfusion defect in the right lung (curved arrows). In the absence of pulmonary infiltrate or emphysematous bullae on a plain roentgenogram (Fig. 4), this area almost certainly represents a pulmonary embolus.

Fig. 4. Postero-anterior and lateral chest roentgenograms taken just before the lung-liver scans. Note that the right mid-lung field is clear in the region of the perfusion defect demonstrated on the lung scan (Fig. 3).

of the right lung base, demonstrated on a chest roentgenogram, cleared after treatment with Penbritin. Because of the persistently elevated white blood cell count a subphrenic abscess was suspected and a combined lung-liver scan was performed. $^{99m}$Tc sulphur colloid 2 mCi and $^{99m}$Tc macro-aggregated albumen 2 mCi was used for the liver scan and the lung scan, respectively. Thirty minutes after intravenous administration of these isotopes, anterior and right lateral rectilinear scans of the chest and upper abdomen were performed (Fig. 3) using a 7,5-cm crystal Picker Magnascanner 500/D. The scans were compared with companion roentgenograms of the chest (Fig. 4) and abdomen and a 6 × 5 cm, well-circumscribed 'cold' defect was demonstrated in the right posterior subphrenic space.
In addition, a large anterior perfusion defects, which was consistent with a pulmonary embolus, was present in the right lung. On the following day the patient developed severe abdominal pain and collapsed. A posterior right subdiaphragmatic abscess was drained, yielding approximately 20 ml of pus. After an initial improvement, the patient deteriorated steadily and she died 4 days after surgery.

**DISCUSSION**

The traditional radiological triad of pleural effusion, basilar atelectasis, and elevated, partly splinted hemidiaphragm, is helpful but unreliable in the diagnosis of subphrenic abscess. Sepsis in and around the liver has become an increasingly difficult diagnostic problem because antibiotics, which partially suppress signs and symptoms, are often used without accurate identification of the site of infection. Scintigraphy offers a valuable, non-invasive examination for patients with subdiaphragmatic problems. The usefulness of the test is of course limited by the extent to which the facilities are available in private and hospital practice.

The procedure is particularly useful for detecting multiple abscesses, and for excluding the presence of an intrahepatic abscess, which may cause similar signs and symptoms. An added advantage, which may alter clinical management, is the detection of previously unsuspected lesions in the lung (e.g. pulmonary embolus in the patient reported above), the liver and the spleen.

**Presence of Pleural Effusion**

It is well documented that even in the presence of pleural effusion, a combined lung-liver scan will successfully differentiate this from a subphrenic space-occupying mass. Coexisting intrathoracic disease, such as pneumonia, or other causes of diminished perfusion to the right lower lung field, makes the interpretation of the combined lung-liver scan more challenging. However, supradiaphragmatic lesions can successfully be differentiated from subphrenic disease by careful correlation of scans with champion roentgenograms of the chest and abdomen.

**REFERENCES**


**Books Received : Boeke Ontvang**


