Although there would appear to be little cause for alarm about hypoparathyroidism following thyroidectomy doctors must certainly be alive to the possibility of this complication. Apart from the exercise of all possible care at the time of operation it does seem prudent to have an estimation of the serum calcium and phosphorus of every patient before and after operation.

Lest physicians should regard thyroidectomy alone as a possible cause of parathyroid insufficiency, it should be recalled that there is experimental evidence that treatment with radioactive iodine may endanger the parathyroids (Parrott *et al.*, 1960). The possibility of parathyroid insufficiency should therefore be considered after treatment of goitre by either surgery or isotopes.

Summary

A total of 123 thyroidectomy cases have been followed up to ascertain the incidence of post-operative parathyroid insufficiency.

The only patient in this series with an abnormally low serum calcium had twice been operated upon for toxic goitre.

Inadvertent parathyroidectomy occurred in about 9% of these cases but was not related to hypoparathyroidism.

Precise records have been kept of the gland residuum in all thyroidectomy cases. The incidence of recurrent goitre and that of post-operative hypothyroidism were within reasonable limits in relation to the length of follow-up.

Routine estimation of the serum-calcium and phosphorus levels is recommended before and after operation.

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DETECTION OF AMOEBIC LIVER ABSCESS BY ISOTOPE SCANNING*

BY

M. SALAH IBRAHIM, M.B., M.R.C.P.Ed.

Lecturer in Medicine, Ein-Shams Faculty of
Medicine, Cairo

M. F. ABDEL-WAHAB, Ph.D.

Lecturer in Radioisotopes Department, A.E.E.,
Cairo

The diagnosis of amoebic liver abscess is not infrequently difficult to establish, even in a country like Egypt, where the condition is commonly encountered. It may be confused with a variety of other conditions which involve the liver itself or adjacent structures, causing pain in the right hypochondrium and giving rise to constitutional symptoms (Craig, 1944; Zuckerbrod *et al.*, 1948; Zavaldá and Hamilton, 1952).

In many cases the diagnosis can be made with certainty only when the characteristic pus is obtained by aspiration of the liver. This is not always a safe procedure to undertake. Moreover, determining the accurate location of the abscess is desirable before aspiration is attempted. In the absence of localizing signs, which are rarely present, several radiological techniques have to be resorted to (Schorr and Schwartz, 1951). These, nevertheless, may not be of much help, and the aspiration has to be performed blindly.

With isotope scanning techniques it has recently become possible to locate space-occupying lesions in the liver without traumatizing effect (Friedell *et al.*, 1958; Donato *et al.*, 1959; Bender and Blau, 1959; Wagner *et al.*, 1961). This has become feasible by using compounds known to be specifically concentrated in the liver. The radioactive substance is injected intravenously, and by means of focusing a highly sensitive gamma-ray detector over different parts of the liver the amount of radiation arising therefrom can be recorded: this is normally uniform. Significant differences in the amount of radioactivity are produced by intrahepatic space-occupying lesions.

The present paper describes our experience with this new technique of diagnosis in a series of 11 patients suspected clinically to be suffering from amoebic liver abscess. A comparison with six suitable control subjects has also been made.

Clinical Studies

The diagnosis of amoebic hepatitis was suspected clinically according to the following: history of general ill-health of fairly recent onset (anorexia, apathy, weakness, rapid loss of weight, etc.); history of pain in the right hypochondrium; low-grade pyrexia and night sweats; enlarged tender liver. Generally all the history relating to these cases was obtained. Abnormal physical signs suggesting slight pleural effusion or consolidation at the lower base of the right lung were present in seven cases. The presentation in one case was haemoptysis. In four cases frank acute dysentery occurred during the three months preceding admission.

The diagnosis in one case was uncertain at first, as the enlarged tender liver was also irregular and firm in consistency. In this case there was a lack of response to emetine and chloroquine before pus was aspirated. In fact, malignancy was highly suspect.

In two cases examination of the stools for amoebae was positive. The white blood count showed a moderate leucocytosis (average 12,500), with a polymorph count averaging 72%. The sedimentation rate, haemoglobin, and liver-function tests were routinely performed in all cases.

Plain x-ray films of the upper abdomen and fluoroscopic examination were carried out in all cases. In nine elevation of the right cupola of the diaphragm was

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clearly shown, and in all of them there was a limitation of the mobility of the right cupola. The Table gives a summary of the important clinical findings.

Clinical Findings				
Case No.	Sex and Age	Duration of Illness (Weeks)	Size of Liver (Finger-breadths Below Costal Margin)	Position and Mobility of Diaphragm
1	M 36	4	5	Raised with limited mobility
2	M 55	3	3	" " " "
3	M 48	10	4	" " " "
4	M 40	5	4	" " " "
5	M 45	3	3	" " " "
6	M 42	4	6	" " " "
7	M 50	2	3	" " " "
8	M 32	8	4	" " " "
9	M 50	6	5	Raised with limited mobility
10	F ?	4	4	" " " "
11	M 35	6	4	" " " "

Methods and Materials

The patient lies supine and the liver surface is marked by palpation and percussion (upper and lower borders). Then 50–100 μ c. of either radioactive rose bengal or a colloidal suspension of radioactive gold (Friedell *et al.*, 1958) is injected intravenously. When radioactive rose bengal is used, 300 mg. of bromsulphalein is given intravenously 10 minutes before the radioactive dye in order to block its excretion (Bender and Blau, 1959) and therefore prolong its passage through the liver.

Scanning is started when the maximal concentration of the radioactive material in the liver has been reached. Normally this is expected to be 20 to 30 minutes with rose bengal and about five minutes with colloidal gold. Scanning is directed from the inferior surface of the liver upwards.

When scanning has been completed, tapping of the liver is attempted with the needle directed towards the suspected area of the abscess (area of reduced radioactivity). As much pus as possible is evacuated, and about 10–20 ml. of lipiodol is injected while keeping the needle in the abscess cavity. X-ray films (postero-anterior and lateral views) are next taken (Cameron and Lawler, 1943). The site of the abscess as demarcated by lipiodol is compared with that obtained by scanning.

It must be stated that there is a definite risk attached to the injection of lipiodol into the abscess cavity, as it may lead to the introduction of secondary infecting organisms. This technique, therefore, should be recommended only as a research procedure in selected cases in which it is desired to check the reliability of the location of the abscess.

Two methods of scanning have been used.

Manual Scanning.—This is performed by placing a single-channel radiation detector at a number of selected points over the liver. At each point the count is recorded for a limited length of time. The different percentage uptakes are then calculated, taking the activity at the lower abdomen at the end of scanning to represent 100%. An arbitrary difference in the counts over the surface of the liver is considered to indicate the presence of an intrahepatic lesion.

Automatic Scanning.—Different types of automatic scanners are available. We have used a high-contrast photoscanner (MacIntyre and Houser, 1957; Bender and Blau, 1959) which consists of a multichannel focusing collimator, a 3 by 3 in. (7.5 by 7.5 cm.) thallium-activated sodium iodide crystal, and a photomultiplier tube. The

probe is automatically moved over the surface of the liver, while impulses of gamma rays which activate a light are simultaneously recorded on an x-ray film. Scattered radiation from the surrounding tissues is selectively eliminated by means of a gamma-ray spectrometer. In this way only the photopeak of the radioisotope is detected, while the background radioactivity is minimized. The radiation emitted from the surface of the liver is thus selectively detected, amplified, and recorded automatically as black lines on the x-ray film after developing.

Results

Scanning of the normal liver gives a more or less uniform pattern of radioactivity, which is maximum over the right lobe. Fig. 1 shows a typical photoscan of a normal liver. The continuous background of radioactivity over this organ is indicated by parallel rows of black lines.

In two cases (Nos. 1 and 2) in which manual scanning was performed a definite more or less circular area of reduced radioactivity was clearly obtained over the right lobe (Fig. 2). The abscess cavity in each as visualized by lipiodol corresponded fairly accurately with that obtained by scanning (Fig. 3 A and B).

In the remaining nine cases photoscanning was employed. A definite area completely or partly devoid

FIG. 1.—Photoscan of a normal liver.

FIG. 2.—Case 1. Diagrammatic representation of percentage uptakes of ¹²⁵I-labelled rose bengal by different areas of liver. Note area of low uptake (90%) in right lobe.

of black line was revealed in seven cases (Nos. 3, 5, 6, 7, 8, 10, and 11). Fig. 4 represents the photostan of Case 6, showing a huge area of reduced radioactivity in the right lobe. In each case the presence of the abscess was confirmed by tapping and its site by visualization with lipiodol.

A homogeneous pattern was obtained in Cases 5 (Fig. 5) and 9, but with much-reduced radioactivity over the right lobe. The liver was tapped in both cases. About 150 ml. of pus was obtained from Case 5, and none from Case 9. These two responded to emetine and chloroquine, and were discharged from hospital symptom-free six weeks after admission. Their liver photostans eventually became normal.

In all cases outlined by scanning the size of the liver was found to be much enlarged and corresponded to that determined clinically.

Discussion

Isotope scanning has been widely used in the past few years for studying many disorders affecting the liver. It proved to be of special value in the discovery of space-occupying lesions involving this organ which, as already mentioned, do not concentrate the labelled substance as does the surrounding normal liver tissue; they can therefore be outlined as areas of decreased radioactivity. Solitary areas of reduced radioactivity are found with amoebic and pyogenic liver abscesses, hydatid cysts, primary and secondary neoplasms, and cavernous haemangiomas. Multiple areas of decreased activity are seen in patients with multiple metastases (Wagner *et al.*, 1961). In the case of neoplasms and cysts the

contrast is sharp and well marked between the normal liver tissue and the lesion.

As might be expected, and was noticed in nine of our cases, the contour of the liver abscess is not well defined owing to the presence of inflammatory reaction in the wall (Gandy and Jammet, 1958).

In Cases 4 and 9 photostanning showed generalized reduced activity over the right lobe, but no definite area was suggestive of an abscess. In Case 4 pus was obtained by aspiration, but unfortunately lipiodol was not injected. The small amount of pus and the direction of the needle suggested that the abscess was probably small in size and placed high up posteriorly. In Case 9 pus was not obtained. The fact that the patient made a very good recovery when he received specific anti-amoebic medical treatment makes it reasonable to presume that either the abscess or abscesses were very small or that the pathological condition was predominantly hepatitis.

The sensitivity of isotope scanning depends, on the one hand, upon the ability of the apparatus employed in detecting significant differences in the amount of radioactivity, and on the other upon the size of the lesion, the thickness of the liver in which the lesion lies, and the depth of the latter inside the former (Wagner *et al.*, 1961). Furthermore, good function of both the liver parenchymal cells and the reticulo-endothelial cells, which take up the rose bengal and colloidal gold respectively, is necessary. An impairment of their functions results in a diffuse decrease in radioactivity.

Manual scanning is somewhat time-consuming, and the point-to-point probe by hand may not be very accurate. However, in two cases it was not difficult to outline an area of decreased uptake. The method appears to be satisfactory when the abscess is large, as it commonly is. Automatic photostanners with their optimal collimation and efficient scintillation crystals provide at the present time a method of considerable accuracy.

From the viewpoint of radiation dosimetry, isotope scanning of the liver is quite safe, as the amount of radiation is negligible. The dose to the liver is approxi-

FIG. 3.—Case 2. Visualization of liver abscess by lipiodol. A: Antero-posterior x-ray film of abdomen. B: Lateral view.

FIG. 4.—Case 6. Photostan showing huge area of reduced radioactivity in right lobe due to amoebic abscess.

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FIG. 5.—Case 5. Photostan showing a homogeneous pattern with much-reduced radioactivity.

mately 0.25 rad with rose bengal and 4 rads with colloidal gold (Wagner *et al.*, 1961).

Summary

Normal subjects and patients with suspected amoebic liver abscess were studied by means of isotope scanning of the liver. Photoscanning was the method chiefly used. The results are compared with those obtained by radiological procedures, especially after visualization of the abscess cavity with lipiodol.

It is concluded that isotope scanning of the liver offers a simple and inexpensive method of accurately diagnosing and locating amoebic abscess within a short time. It is more reliable and takes less time than most of the radiological procedures in use. It is also non-traumatizing to the liver and is quite safe from the viewpoint of radiation dosimetry.

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Medical Memoranda

Portal Gas Embolism: A Prognostic Sign in Mesenteric Vascular Occlusion

[WITH SPECIAL PLATE]

The radiological demonstration of gas in the portal venous system is a rare finding of grave import. In no case reported in the literature has the patient recovered; most die within 24 hours, the longest survival being seven days.

The condition was originally described in four infants with intestinal obstruction by Wolfe and Evans (1955), who could find no previous report in the literature. Since then two further papers have appeared in America (Susman and Senturia, 1960; Wiot and Felson, 1961), and Barrett (1962) has published the first and only report in this country, bringing the number of cases with x-ray signs to 10, of which six were in adults.

The occurrence of a personal example in a patient with mesenteric vascular occlusion led to a retrospective review of similar cases admitted to this hospital in the past 10 years, when two further examples were found.

CASE HISTORIES

Case 1.—A woman aged 75, a known case of aortic stenosis and mitral incompetence, gave a history of vomiting, distension, diarrhoea, and severe lower abdominal pain for three days prior to admission. On examination she was dehydrated, and the abdomen was distended, very tender, and tympanitic. Bowel sounds were faint. Rectal examination showed red-black altered blood. An x-ray film of the abdomen (see Fig. on Special Plate) showed dilatation of the small intestine with fluid levels. There was a reticular pattern of gas shadows overlying the liver corresponding to the distribution of the bile-ducts or portal veins. These shadows extended to the periphery of the liver. A diagnosis of mesenteric embolism was made, and gastric suction and intravenous replacement therapy were instituted prior to operation. However, the patient's condition deteriorated rapidly, and she died in a state of peripheral circulatory failure eight hours after admission, and before operation could be carried out. Post-mortem examination confirmed the presence of an embolus in the

superior mesenteric artery, causing gangrenous changes in the whole small intestine.

Case 2.—A woman aged 68, who had suffered from rheumatoid arthritis for many years, complained of colicky lower abdominal pain and vomiting for 12 hours prior to admission. There had been no constipation. On examination she was dehydrated and emaciated. The abdomen was distended, but there was no tenderness. Bowel sounds were infrequent and weak. X-ray examination of the abdomen showed distended loops of small bowel. There were vascular gas shadows in the right lobe of the liver near the periphery. The patient was thought to have acute pancreatitis, and intravenous infusion and intestinal suction were started. Her condition rapidly deteriorated, and she died 24 hours after admission. Post-mortem examination showed that 1.5 metres of ileum was gangrenous due to mesenteric vein thrombosis.

Case 3.—A man aged 84 was seized with acute lower abdominal pain four hours before admission. The pain was increasing in severity, tending to be maximal in the right iliac fossa. He had vomited bilious material twice, but had not been constipated. On examination he was moderately shocked. There was marked tenderness and guarding in the right iliac fossa. No bowel sounds were heard. There was no blood on rectal examination. X-ray examination of the abdomen showed numerous fluid levels on the right side. Gas shadows were seen in the portal tributaries at the periphery of the right lobe of the liver. At operation a long segment of gangrenous small intestine was found. The cause was mesenteric artery occlusion. In view of the patient's age and condition, resection was not considered feasible. He died 12 hours after operation.

COMMENT

The x-ray presentation of portal gas embolism has been reported 13 times (including the present series). The apparent rarity of the condition may have several explanations: (1) many of the patients with the condition are not x-rayed; (2) patients are often cardiac cripples and very ill so that the quality of the portable x-ray films taken under these conditions may be inadequate and not include the liver area; and (3) the appearance of portal gas may be transient.

A review of 28 cases of mesenteric vascular occlusion (proved by operation or post-mortem examination) from the records of this hospital in the past 10 years confirms the above suspicions. Only 21 of the 28 were x-rayed, and of these the liver region was not included