Surgical Management of Hepatic Abscess

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Liver abscess has been associated with late diagnosis and a high mortality. Because this disease is not common, failure to consider the diagnosis and delay in recognition have contributed significantly to poor results in treatment. Inadequate late surgical drainage and failure to accurately identify causative organisms are additional important reasons why the mortality has been greater than 70 per cent [*1,2*]. This high mortality associated with liver abscess can be reduced by applying important diagnostic and therapeutic technics which have been developed in recent years. The present report is based on a detailed analysis of fifty-five patients with hepatic abscess treated at the Santa Clara Valley Medical Center from 1940 through 1968.

Classification of Liver Abscesses

Incidence. The age of the patients at the time of diagnosis ranged from one and a half to eighty-five years, with the average age being forty-six years. This age incidence is in contrast to several other reports in which hepatic abscess appeared to be a disease of older age [*3,4*]. In this series of patients liver abscess occurred in men more frequently than women in a ratio of 3 to 1.

Etiology. An attempt should be made to differentiate amebic and pyogenic abscesses. This separation was indistinct early in this series prior to 1950. Classification of abscesses in twenty-seven patients since 1950 is shown in Table I. Rarer types of abscess such as ecchinococcic, actinomycotic, traumatic, and infected congenital cysts were not seen in this series. One very unusual case of liver abscess caused by adult Ascaris lumbricoides in a one and a half year old girl was successfully treated.

Anatomic Source of Infection. The classification of the fourteen pyogenic abscesses from 1950 to 1968 based on their anatomic source of infection is shown in Table II. The majority of pyogenic abscesses involved the right lobe and occurred in relation to the portal vein draining infected abdominal viscera. Only two of fourteen pyogenic abscesses involved the left lobe. Serege's rule of abdominal visceral drainage, that is, superior mesenteric venous blood tends to drain to the right hepatic lobe whereas splenic and inferior mesenteric drainage usually flows to the left hepatic lobe, may be partially supported by these results.

Single or Multiple Abscesses. It is important to know whether abscesses are single or multiple. Of twenty-seven abscesses treated since 1950, twenty-one were single, five were multiple, and one was multilocular. The abscess was single in all five of the patients for whom the origin of the abscess was unknown.

Bacteriology. The organisms identified and grown by culture are shown in Table III. Escherichia coli was the most common pyogenic organism. Cultures were negative from four solitary abscesses believed to be pyogenic. There has been a gradual increase in the number of gram-negative organisms cultured from hepatic abscesses in the past ten years [*3*]. It is likely that with greater efforts to identify fastidious anaerobes and microaerophilic organisms they will also show an increased incidence [*5,6*].

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TABLE I Etiology of Liver Abscess from 1950 to 1968

Etiology		No. of Patients
Amebic		13
Proved	6	
Suspected	7	
Pyogenic		14
Total		27

Management Problems

Early Recognition of Hepatic Abscess. "The chief aid to the diagnosis of the disease is the knowledge that it may occur" [7]. Failure to think of the diagnosis or to consider it seriously has been one of the most important factors contributing to the high mortality in the past. The symptoms and signs of hepatic abscess are usually nonspecific and may be misleading in the early stages of development. They are as follows:

1. Fever, chills, sweats
2. Right costal or subcostal pain
3. Enlarged tender liver
4. Elevated diaphragm with pulmonary signs
5. Right pleural effusion
6. Leukocytosis
7. Jaundice (rare)

These features, when present in combination, are characteristic enough to make the diagnosis likely. However, this combination may be evident only late in the course of hepatic abscess.

All patients in this series had fever, but temperature patterns varied from patient to patient and only half in the series had records of swinging or spiking temperatures. These latter patients frequently had associated chills and diaphoresis.

Pain, either right upper abdominal or subcostal, was frequently present and was constant and dull in nature. Liver enlargement with tenderness was common and sometimes difficult to distinguish from findings of subacute cholecystitis. Shoulder pain was not common and occurred in only two patients. Preadmission duration of symptoms ranged from a week to three months with an average of one month.

Of the thirteen patients with amebic abscess only three had a history of diarrhea, but careful stool examination and culture failed to reveal ameba in the stool. The amebic abscess is usually more insidious in onset and produces a less acute clinical picture than pyogenic abscesses. Amebic abscesses are almost always single and are located high posteriorly in the right hepatic lobe.

TABLE II Anatomic Source of Infection in Pyogenic Liver Abscesses from 1950 to 1968

Source		No. of Patients
Portal drainage		8
Cholecystitis	4	
Diverticulitis	2	
Gastric ulcer perforation	1	
Enteritis	1	
Cholangitis		1
Stones		
Source unknown		5
Total		14

TABLE III Etiologic Organisms in Patients with Hepatic Abscess from 1950 to 1968

Organism	No. of Patients
Pyogenic organisms	
Coliforms	5
Pseudomonas	1
Enterococci	2
Streptococci	1
Staphylococci	1
Culture negative	4
Amebic	
Trophozoites identified	6
Suspected but not seen; culture negative	7
Total	27

Jaundice was rare and usually associated with biliary tract obstruction, cholangitis, and miliary liver abscesses. These findings contrast to those in the collected series of Ochsner, DeBakey, and Murray [2], in which jaundice was present in one third of the patients.

An association between solitary liver abscesses and diabetes mellitus was recently suggested by Holt and Spry [8]. They found that five of fourteen patients with solitary hepatic abscess had diabetes and none of the five patients with multiple abscesses had diabetes. In our series three of twenty-one patients with solitary hepatic abscess had diabetes and none

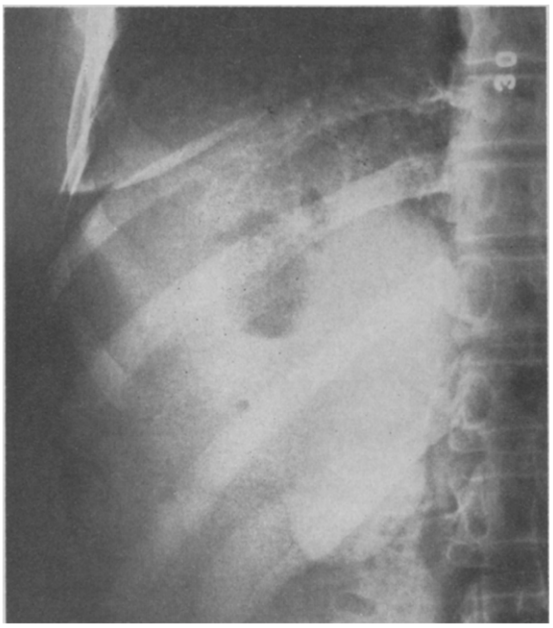


Fig. 1. Plain abdominal roentgenogram taken during intravenous cholangiography in patient M.L. showing large abnormal air pocket in right upper quadrant. Note gallbladder filled with dye.

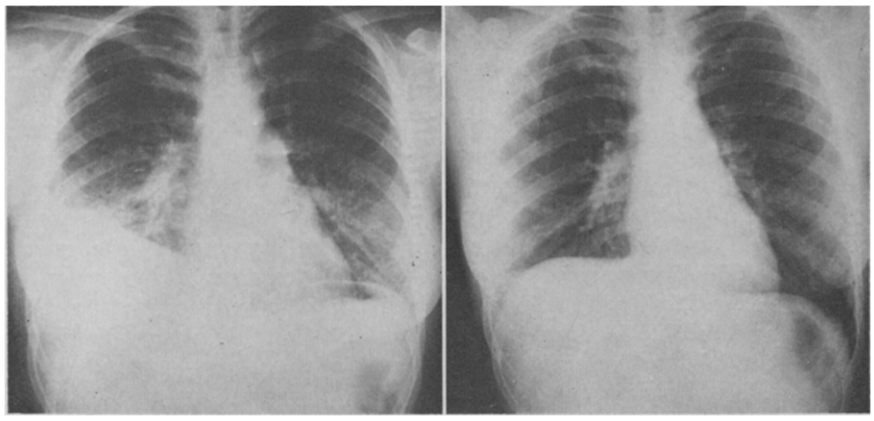
of the five patients with multiple abscesses had diabetes.

Laboratory studies were not particularly helpful in establishing the diagnosis. The white blood cell count ranged from 6,000 to 26,000 per mm^3. with an average count of 16,000 per mm^3. In general, patients with pyogenic abscess tend to have a higher white blood cell count. Elevation of serum alkaline phosphatase and hypoalbuminemia were present only occasionally, in contrast to the 75 per cent occurrence reported by Ostermiller and Carter [*9*].

X-ray studies of the abdomen and chest may contribute to suspicion of an intrahepatic abscess and in this series were helpful in several cases. Abnormal gas collections seen on plain abdominal films led us to seek additional diagnostic procedures such as hepatic photoscan in several patients. (Fig. 1.) Changes seen on roentgenogram of the chest of elevated right diaphragm, atelectasis, and pleural effusion were frequently present. (Fig. 2.) These changes can lead to the diagnosis of primary pneumonic disease when subdiaphragmatic and intrahepatic disease should be considered. Additional roentgenographic studies such as fluoroscopy, gastrointestinal baruim studies, and cholangiography were not often helpful. The single most valuable diagnostic study was the hepatic photoscan which was employed in most of the patients in this series since 1960. This test will be discussed in detail herein.

Recognition of hepatic abscess even at the time of celiotomy can be difficult and two abscesses in this series were missed by the surgeon during abdominal exploration. The liver may be diffusely enlarged but there are usually no apparent local changes. Occassionally an area of softening may be felt if the abscess is located near the liver surface.

Localization. Even when an hepatic abscess is known to be present, localization can



A B

Fig. 2. Chest x-ray changes in patient O.R. before (A) and after (B) treatment of right lobe hepatic abscess. Elevated right diaphragm, right lower lobe atelectasis, and pleural effusion present preoperatively have markedly improved early postoperatively.

sometimes be very difficult. Preoperative studies may not define the anteroposterior limits of a solitary abscess and multiple abscesses can easily be missed, even at the time of operative exploration. Multiple aspirations of the liver with a large bore needle at the time of exploration may be necessary to accurately identify and localize the abscess(es).

Adequate Drainage. Failure to provide adequate drainage has been a major problem contributing to the mortality with hepatic abscess. Choice of operative approach is important and has to be directed according to the location of the abscess(es).

Hepatic abscesses often require prolonged drainage over a period of weeks or months with slow gradual advancement of drains. Premature removal of drains results in external healing with residual intrahepatic dead space where recurrent abscess forms.

Identification of Causative Organism. Differentiation between amebic and pyogenic abscess is often difficult without accurate identification of the infecting organism. Failure to carefully examine the fresh drainage material for amebic trophozoites and failure to properly culture a fresh specimen for the wide variety of possible aerobic and anaerobic causative organisms has been a common cause of false-negative cultures. Systemic treatment, as well as local drainage, is important in most patients. Intelligent use of antibiotics and chemotherapeutic agents requires accurate identification of the causative organism. A negative bacterial culture may indicate merely inadequate culture technic for anaerobes resistant to identification, results of previous antibiotic therapy, or amebic rather than bacterial abscess.

Recognition and Elimination of Source. Of twenty-seven patients with hepatic abscess since 1950, the source of infection was known in twenty-two. In these patients, treatment was outlined to include local drainage of the liver, elimination of the contributing sources of infection (that is, removal of infected gallbladder), and systemic antibiotic therapy to prevent dissemination of further infection. The problem of possible abscesses elsewhere (such as the brain or kidney) in the patient with a liver abscess must be considered and aggressive investigation pursued if suspected. Five patients with pyogenic abscess did not have a known source of primary infection.

TABLE IV Results of Treatment

Result	No. of Patients	Mortality	
		No.	Per cent
1940–1950			
Surgical drainage	4	1	
No drainage	24	24	
Total	28	25	90
1950–1968			
Surgical drainage	14	0	
Closed aspiration	3	0	
No drainage	10	8	
Total	27	8	30

Results of Treatment

The very high mortality of 90 per cent (Table IV) in the twenty-eight patients with hepatic abscess before 1950 was due primarily to failure of recognition and inadequate drainage. All five of the management problems discussed herein contributed to these poor results. During this period all twenty-four patients without drainage died as a result of the disease process, whereas of the four patients treated with surgical drainage during the same period only one died.

The over-all mortality in twenty-seven patients treated since 1950 was 30 per cent with no deaths in seventeen patients treated with either open surgical drainage or closed aspiration. Increased awareness of the disease and use of liver photoscan are thought to be the most important factors contributing to this marked reduction in mortality. These two factors have resulted in an earlier accurate diagnosis and improved technics of adequate drainage.

Complications since 1950 have usually been recognized and treated early. Two patients required a second drainage procedure and one patient required a third. Other complications in this series include one retroperitoneal abscess, one subphrenic abscess, one wound dehiscence, two upper lobe pneumonias, two hepatopleural fistulas, two cases of septicemia, and two of emetine toxicities. The significant morbidity of this disease is further made evident in the average hospital stay of seven weeks for patients with both amebic and pyogenic abscess.

Management Technics

Hepatic Photoscan. The recent use of hepatic photoscanning technics in our institution

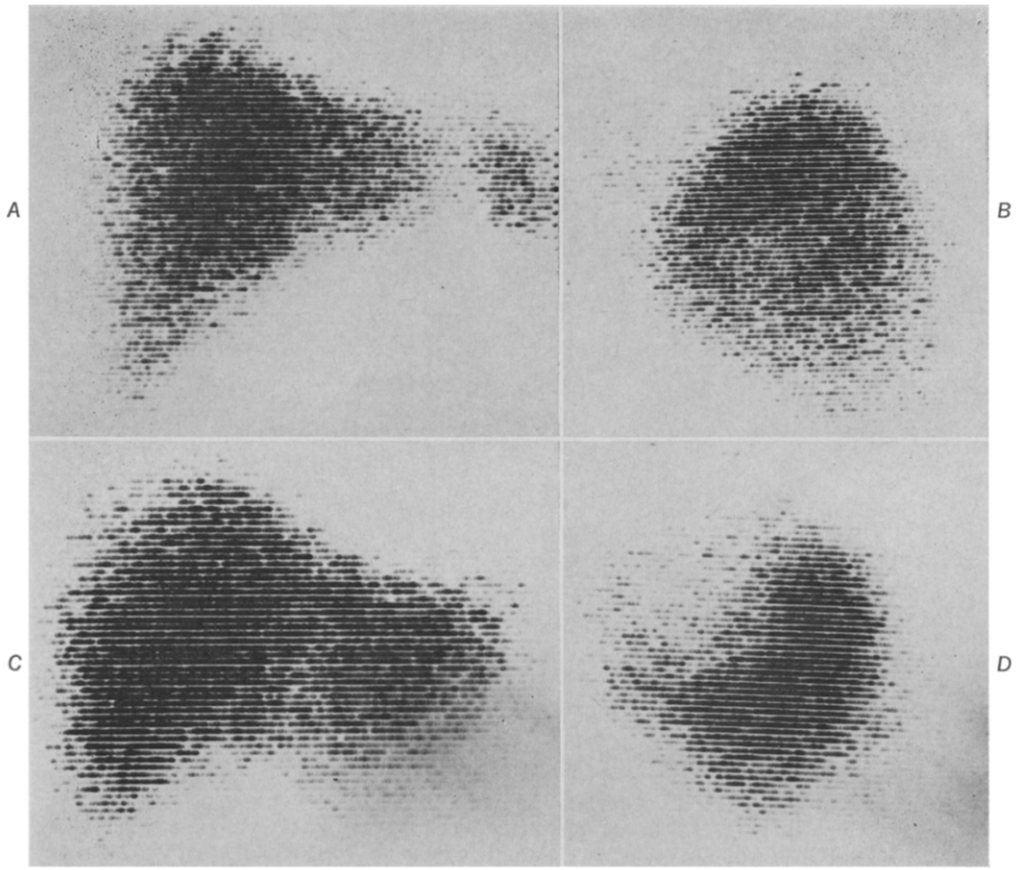


Fig. 3. Preoperative anterior and right lateral colloidal 198-Au hepatic photoscans in two patients with large solitary posterior right lobe abscesses. A, anterior scan of patient M.L. shows decreased uptake along right lateral margin. B, right lateral scan of patient M.L. localizes the defect in the posteroinferior portion of the lobe. C, anterior scan of patient O.R. shows some enlargement of the liver and a concave indentation along the right superior and lateral margin. D, right lateral scan localizes a large defect high in the posterosuperior portion of the right lobe.

has been the single most important factor in improving mortality and morbidity of hepatic abscess. The hepatic photoscan enables the clinician to make a nearly accurate diagnosis. In addition this technic gives valuable information about the presence, location, size, and number of abscesses. With this information it is now possible to choose the most expeditious route for evacuation of the cavity. The use of this technic in the management of liver abscess was reported by Wagner, McAffee, and Mozley [*10*] in 1961 utilizing rose bengal 131-I. Schuman et al. [*11*] reported the successful treatment of seven consecutive patients with hepatic abscesses and they attributed their improved mortality to the application of this technic.

We have utilized colloidal 198-Au for hepatic photoscanning. Although the use of 198-Au gives the patient slightly more radiation, it has the advantage of staying in the liver for a longer time, which is important because it allows scanning of multiple projections of the liver. The importance of obtaining photoscans in both anterior and lateral projections has been well demonstrated in our series. (Fig. 3.) With anterior projection alone, it is difficult to accurately locate the abscess and quite possible to miss it entirely. More recently we have used the Anger camera in conjunction with injection of 198-Au to obtain hepatic photoscintigrams. This technic allows even more versatility in obtaining multiple projections of the liver in a short period of time.

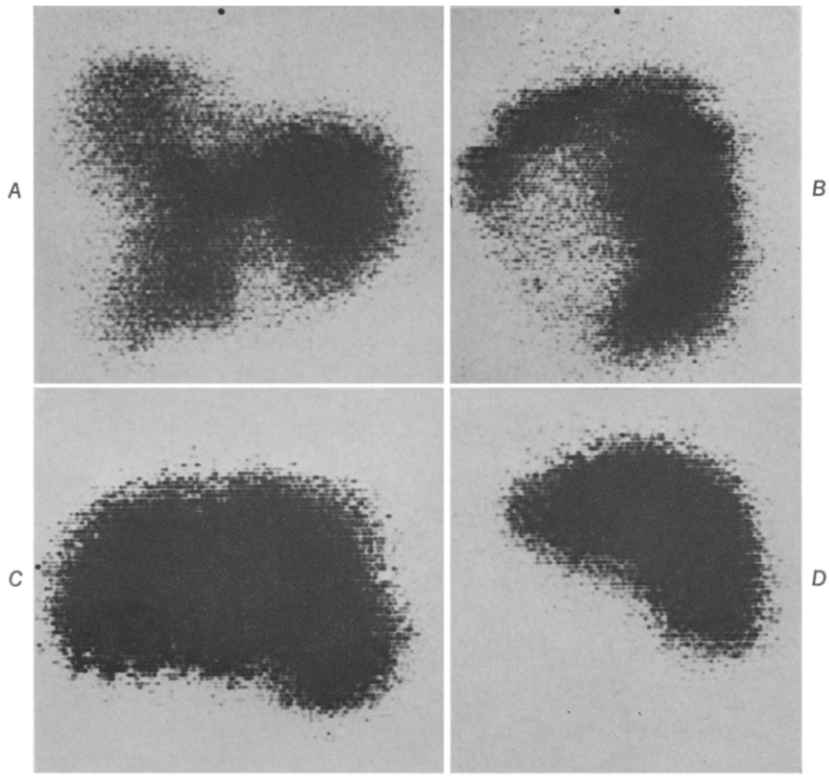


Fig. 4. Anterior and right lateral colloidal 198-Au hepatic photoscans of a patient (A.R.) with three major hepatic abscesses. A, preoperative anterior scan shows gross indentation defects along superior, right lateral, and inferior margins. B, preoperative right lateral scan shows large posteroinferior defect and indentations on the anterosuperior margin. C and D, postoperative anterior scan and right lateral scan one month after open surgical drainage which included both left anterior abdominal approach and right posterior lateral approach through the twelfth rib bed. Postoperative scans show that the previous large defects are almost filled with functioning liver tissue.

A normal scan has been effective in excluding the diagnosis of hepatic abscess. However, there is a lower limit of discrimination for appreciation of a defect of about 2 cm. in diameter and single abscesses smaller than this may not be identified. It must be remembered that a filling defect in the liver scan does not establish the diagnosis of "abscess" and clinical correlation is required to exclude metastatic or primary cancer, benign tumor or cyst, or an hepatic anomaly. Serial hepatic photoscans have also been helpful to provide objective evidence of changes of size of the lesion during therapy. (Fig. 4.)

Drainage Technics. Surgical management of hepatic abscess is individualized with each patient. Choice of drainage procedure includes closed aspiration and several approaches to open surgical drainage. These technics are as follows:

1. Open drainage. Posterior extraserous approach: When the clinical findings and liver scan identify a solitary abscess located posteriorly in the right lobe, the approach is posterior or lateral through the bed of the appropriate rib. After rib resection, the rib bed may be sutured to the diaphragm and/or posterior peritoneum to wall off the site of proposed drainage. (Fig. 5A, B, and C; also see Fig. 3.) After initial trocar aspiration it is important to explore the cavity with the examining finger to eliminate commonly found loculations. (Fig. 5D.) Aspirated material is taken for direct examination and cultures, biopsy of the abcess wall is carried out, and multiple large soft rubber drains are placed in the cavity. Bleed-

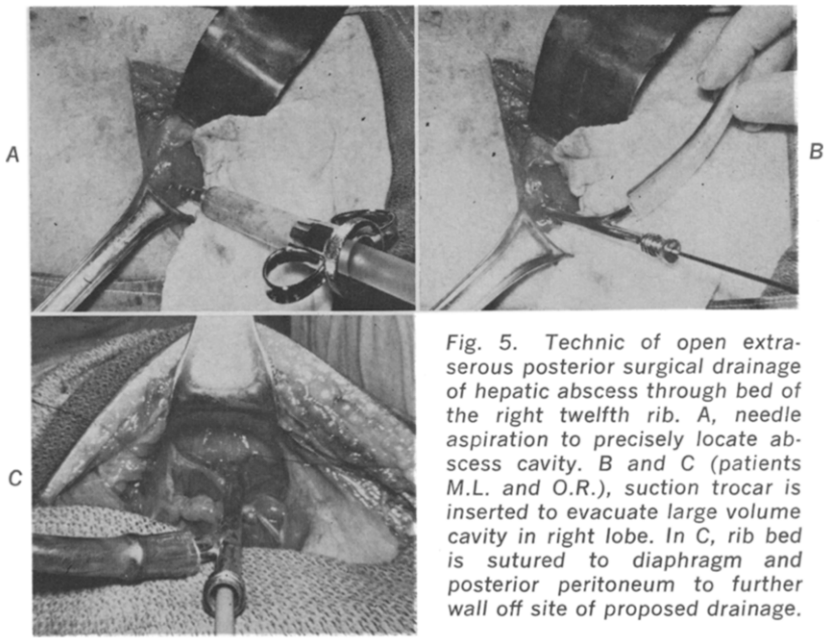


Fig. 5. Technic of open extraserous posterior surgical drainage of hepatic abscess through bed of the right twelfth rib. A, needle aspiration to precisely locate abscess cavity. B and C (patients M.L. and O.R.), suction trocar is inserted to evacuate large volume cavity in right lobe. In C, rib bed is sutured to diaphragm and posterior peritoneum to further wall off site of proposed drainage.

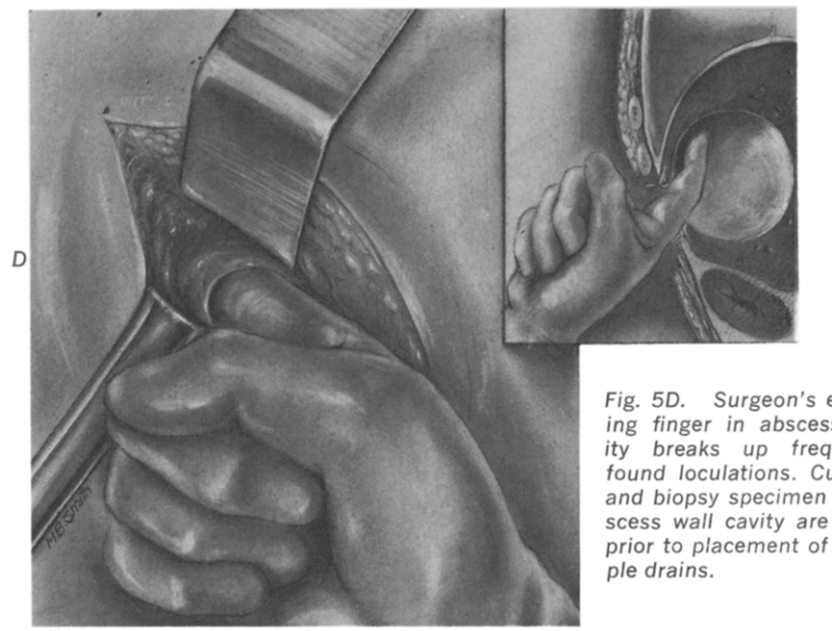


Fig. 5D. Surgeon's exploring finger in abscess cavity breaks up frequently found loculations. Cultures and biopsy specimen of abscess wall cavity are taken prior to placement of multiple drains.

ing is usually minimal and gauze packing is avoided so as to allow free dependent drainage from the cavity.

2. *Open drainage. Anterior transperitoneal approach:* When the hepatic abscess is located anteriorly in the right lobe or in the left lobe, the approach is anterior transperitoneal through a subcostal incision. This approach not only gives good exposure for the known anterior abscess, but also allows the surgeon to thoroughly explore the entire liver with large bore needle aspiration for the presence of additional abscesses. It is the preferred approach when multiple abscesses are known or suspected. There is the advantage of being able to first explore the peritoneal cavity and document other suspected intra-abdominal disease which could be contributing to the hepatic

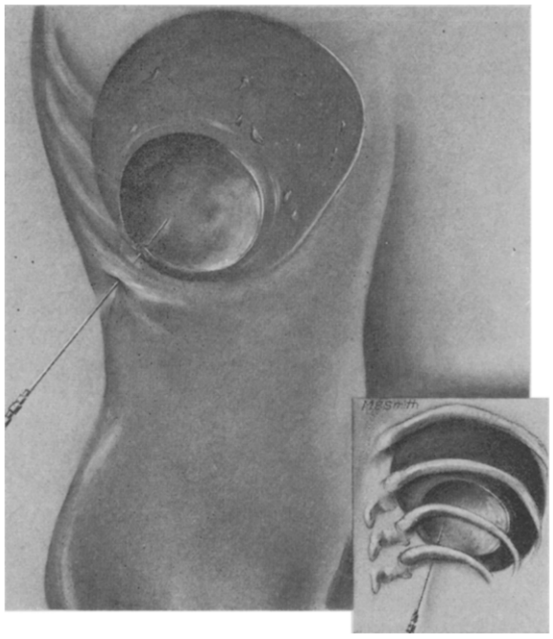


Fig. 6. Closed needle aspiration of large right lobe amebic abscess. Posterolateral approach beneath right twelfth rib using long Teflon® spinal needle with stylet.

abscess. This approach has the disadvantage of less dependent drainage and the hazards of generalized peritoneal contamination. If the anterior approach is used and a large posterior right lobe abscess is discovered during exploration, the abdominal incision should be closed, the patient turned, and the posterior rib resection approach used. A planned combined anterior and posterior rib bed approach has been used successfully in several patients with multiple large abscesses. (Fig. 4A and B.)

3. Open drainage. Anterior extraperitoneal approach: Occasionally a large anterior abscess will be located close to the liver surface and cause the liver to be adherent to the parietal peritoneum in the region of the abscess. In this instance it may be possible to avoid opening into the general peritoneal cavity.

A two stage anterior extraperitoneal approach has been described [*2*] and used once successfully in our series. The first stage consists of promoting adhesions between the liver and the costal abdominal wall by suturing the nonadherent liver to the deep margins of the abdominal incision and packing the liver surface and wound edges with iodoform gauze. The second stage is performed at a second operation two days later and consists of removing the pack and incising and draining the abscess through the area of the liver now adherent to the margins of the wound. This technic has the obvious disadvantages of requiring two operations and a delay before drainage.

4. Closed aspiration. Percutaneous approach: McFadzean, Chang, and Wong [*12*] reported 100 per cent success in twenty cases of solitary pyogenic abscess of the liver treated by closed aspiration and antibiotics. In this remarkable series they stated that there were no complications secondary to the theoretical danger of contaminating the pleura and peritoneum. Other subsequent reports concerning this technic have not shown such spectacular results. We have recently utilized a similar technic in three selected patients with solitary posterior amebic abscess with good success and no complications. We have not utilized this technic in patients with known or suspected pyogenic abscess. Figure 6 shows the general approach for posterior abscesses. The procedure is performed with the patient under local anesthesia and in the sitting position. The direction and depth of needle placement are guided by analysis of multiple projection liver scintigrams. Aspiration of large volumes of pus may result in pain to the patient. Periodic replacement of aspirate with air during the procedure seems to prevent or alleviate this discomfort. Repeated aspirations are usually necessary with large abscesses. Hypaque® instillation is helpful to further outline and localize the abscess and has been useful in conjunction with serial scans to follow liver repair after drainage. Antiamebic drugs are administered to patients in whom there is suspicion of amebic origin of the abscess.

Bacteriologic Identification. Immediate examination of fresh aspirate by personnel experienced in identifying amebic trophozoites is essential to accurate differentiation of liver abscesses. Identification of trophozoites is often possible only by examining the wall of the abscess cavity. Therefore, a biopsy specimen should be taken for microscopic examination and culture [*13*]. Gram staining should also be carried out on fresh material and the specimen cultured. The bacteriologist should be alerted to the specimen source so that he may employ special culture technics not only for common aerobic organisms, but also for

fastidious anaerobic and microaerophilic organisms that seem to occur freqeuntly in liver abscesses. These extra efforts in identifying the causative organism have proven necessary to intelligently treat the patient systemically with antibiotics and antiamebic drugs.

Summary

Fifty-five cases of hepatic abscess occurring over a twenty-eight year period are reported. The use of hepatic photoscans, early diagnosis and drainage, and the appropriate use of antibiotics have resulted in a marked improvement in mortality. The clinician must remain aware of this diagnosis if optimal results in treatment are to be obtained.

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Discussion

LEONARD ROSOFF (Los Angeles, Calif.): An evaluation of the results of therapy of hepatic abscess must clearly differentiate between the two principle etiologic forms of this disease, namely those of amebic and those of bacterial origin, although the differentiation, at times, is difficult to establish clinically. Since 1955 more than 200 patients at the Los Angeles County-USC Medical Center have had a diagnosis of amebic liver abscess, in many cases on the basis of response to anti-amebic drug therapy and recently also by the indirect hemoagglutination test of Kessel. Percutaneous needle aspiration of the abscess has been used in approximately 50 per cent of these patients, primarily to establish a precise diagnosis, and on rare occasion, for drainage of a large abscess. No morbidity has been associated with this procedure. It has been used with decreasing frequency in recent years. In none of these patients has open drainage been carried out. Drug therapy has consisted of chloraquine for a two to three month period to avoid recurrence, supplemented by Diodoquine® for the intestinal amebiasis. In some instance, emetine has been used in addition to chloraquine. There has been no mortality in this group of patients. The therapeutic value of needle aspiration has not been established. We believe that operative treatment of amebic liver abscess should be reserved for the extremely rare case which possibly may not respond to nonoperative treatment or for acute rupture of an untreated abscess into the peritoneal or pleural cavities. A recent report by Sheehy et al. indicates that neither operative drainage nor needle aspiration significantly shortens the resolution time of an amebic liver abscess.

In contrast to the authors' experience, liver abscess of bacterial origin is becoming increasingly rarer in our hospital, despite the extremely large number of seriously ill patients admitted with far advanced suppurative lesions of the biliary and intestinal tracts. It is possible that this may be the result of the intensive antibiotic therapy employed in the treatment of the primary disease. Such abscesses, when seen, frequently respond to appropriate antibiotic therapy and needle aspiration, and the role of open drainage as a primary procedure remains questionable.

In their report the authors indicate that in their second group of twenty-seven cases, there were eight deaths and that these occurred only in the ten patients not treated by drainage. How many of these eight patients had a precise diagnosis of hepatic abscess before their death and how long before? How many had received optimal nonoperative therapy for the treatment of the abscess? And finally, did a review of the necropsy

records reveal that open drainage of the abscess per se would have significantly altered the ultimate result?

RICHARD CARTER (Irvine, Calif.): The high death rate associated with pyogenic liver abscess has, in large part, been related to the difficulty in establishing an early diagnosis in a baffling disease.

The roentgenogram has been the chief diagnostic tool in the past, but this modality is limited by the inability to distinguish differences in densities above or below the diaphragm, or within the liver itself.

The frequently associated abnormal chest x-ray findings in liver abscess may be misleading and often direct attention to the thorax. A subphrenic collection was associated in 45 per cent of patients in our study of liver abscess (*Arch. Surg.*, 94: 353, 1967).

The combined lung-liver radioisotope scan has been shown to be a safe, comparatively simple and reliable method of outlining the space between the liver and the lung. This procedure is of real value in the study of patients suffering from disease above the diaphragm, such as lower lobe pneumonia, pulmonary infarction, or loculated pleural effusion. It usually provides a striking picture of subphrenic abscess when one is present.

The combined lung-liver photoscan is not only helpful in correlating vague clinical features for more exact diagnosis, but also it facilitates localization of the abscess for precise surgical drainage.

JAMES B. D. MARK (closing): To answer partially one of Dr. Rosoff's questions, I would like to emphasize that in the amebic abscess it is many times not possible to recover the trophozoites from the pus by needle aspiration or open drainage; rather, a biopsy specimen of the wall of the abscess must be taken to appreciate the presence of trophozoites.

We frequently "get by," particularly with the amebic abscesses, without open surgical drainage, and depend on aspiration and drugs alone, but I think there is a vote in some cases for drainage of these abscesses, particularly when the diagnosis is in doubt.

I think that the principle of abscess drainage in pyogenic abscesses particularly is well borne out by the material presented. Our impression was that the deaths in these patients were mainly due to lack of appreciation of the presence of an abscess and then treatment without drainage. Dr. Rosoff mentioned that he prefers to treat rupture if it occurs. We would far rather prevent rupture and prefer to drain the pus rather than having it run through the diaphragm into the lung and cause rather severe complications in that direction and perforate into the peritoneal cavity.

We agree with Dr. Carter that the combined lung and liver scan can be useful. We have had very good results using only the liver scan in most of these patients.

We had a sixty-four year old Indonesian woman who presented with a five day history of abdominal pain radiating to the chest and back; she also had nausea and vomiting. She had had similar trouble two years ago while she was in Indonesia, at which time she was told she had an enlarged liver. On examination she had no tenderness in the right upper quadrant and the bilirubin was 1.4. Roentgenograms showed a markedly elevated hemidiaphragm on the right. Our residents believed that a liver abscess was possible and they obtained a photoscan which showed the right lobe of the liver to project much higher than the left lobe; a lateral scan confirmed the abscence of any filling defects. The patient was then operated upon, whereas she might have been treated without operation for a little bit longer on the basis of the clinical diagnosis of liver abscess alone. She was found to have a perforated gallbladder with stones in the peritoneal cavity and common duct, and histolgic examination showed that she had invasive carcinoma of the gallbladder which was not appreciated at the time of operation.