

Clinical Review of Hepatic Abscess in Korea

Y. Kim, J.S. Min, K.C. Whang

Dept. of General Surgery, College of Medicine, Yonsei University

INTRODUCTION

Since Hippocrates described hepatic abscess, numerous articles have been published and also great progress in the knowledge of this disease has been made.

Korea which belongs to the temperate zone is known to be a country with a high morbidity rate for amebic dysentery and the incidence of amebic abscess of the liver is also high, as already described by Ludlow in 1923.

Deulafoy (1898) reported about 100% mortality from liver abscess and Petren (1914) 95%, Otschkin (17) 80%, Ochsner (16) reported 100% mortality in non operative cases and 50.9% in operative cases.

With the advent of chemotherapy and specific antibiotics the mortality rate has much decreased, but it is still a problem that indiscriminate use of various antibiotics have brought changes of the clinical course and its prognosis. So the authors have reviewed its incidence, etiologic factors, clinical picture, laboratory data, X-ray findings, treatment, complications and mortality and also compared them to previous statistical reports.

MATERIALS and METHOD

Subjects were 227 patients who were admitted to Severance Hospital College of Medicine,

Yonsei University, from July 1955 to Jan. 1971 and who were confirmed as liver abscess by operation or aspiration. Those cases which suggested liver abscess by clinical or X-ray picture was excluded.

These 227 cases were compared as to whether they were pyogenic or amebic abscess, and also by age, sex, clinical picture, X-ray findings, complications and mortality.

RESULTS

A. Incidence

1. Classification of liver abscess

Pus was obtained by aspiration or operation and was classified as an amebic abscess if it was chocolate brown color or anchovy paste even if no ameba were found. Others were classified as pyogenic abscess (Fig. 1).

2. Sex incidence

Among 94 cases of pyogenic liver abscess, males constituted 74.4% and females were 25.6%. In 133 cases of amebic abscess, males (107 cases) were 80.4% and females (25 cases) were 19.6%, so the average sex ratio of male to female was about 4 to 1 (Fig. 2).

3. Age incidence

Age distribution showed 27.7% were the 4th decade and 28.7% in the 5th decade in cases of pyogenic abscess and 32.3% and 28.6% in those same decades in cases of amebic abscess (Fig. 3).

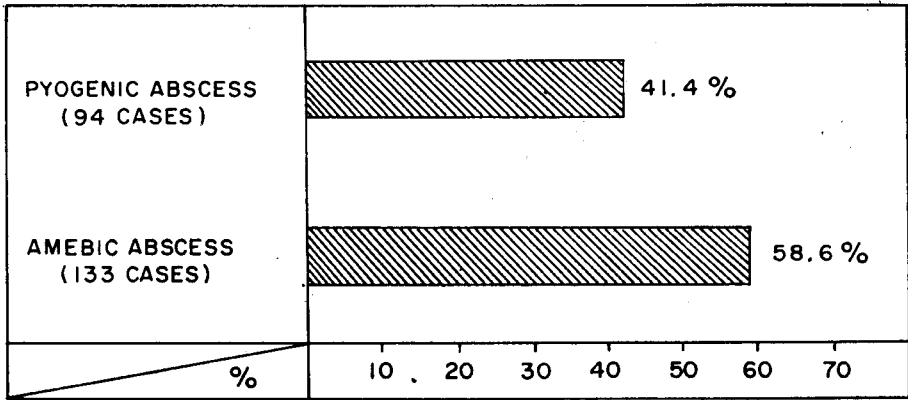


Fig. 1. Etiological classification of liver abscess & number.

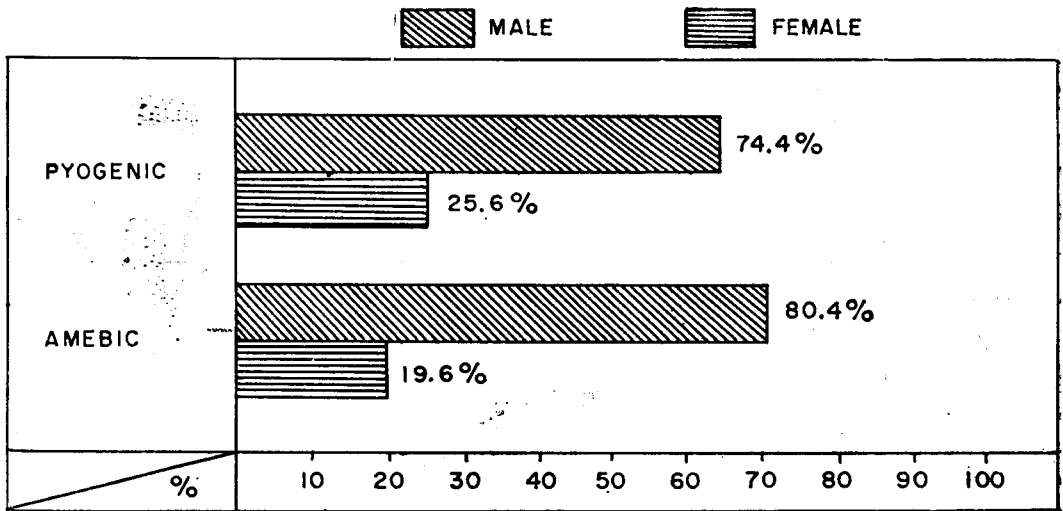


Fig. 2. Sex distribution.

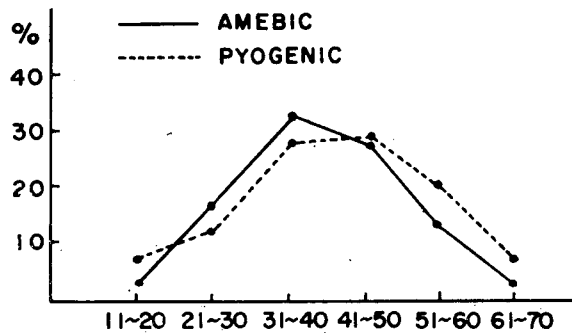


Fig. 3. Age incidence.

B. Clinical Symptoms and Physical Findings

Clinical symptoms were varied but localized tenderness, fever and chills were the most common findings. Colicky pain was noted in 81.9% of the pyogenic abscesses and in 88.7% of the amebic abscesses and this pain was mostly localized in the R.U.Q. or the right lower chest region.

Fever was noted in 69.1% of the pyogenic abscesses and in 75.3% of the amebic abscesses. Chills were noted in 40.4% of the pyogenic abscesses and in 39.8% of the amebic abscesses.

On physical examination localizing tenderness and hepatomegaly were the most common findings. Hepatomegaly was noted in 47.9% of the pyogenic abscesses and in 45.1% of the amebic abscesses (Table 1).

C. Duration

Most of the patients were admitted within one week after onset of symptoms in both

Table 1. Clinical symptoms

Symptoms	Amebic		Pyogenic	
	No.	%	No.	%
Abdominal pain	118	88.7	77	81.9
Fever	100	75.3	65	69.1
Chills	53	39.8	38	40.4
	56	42.1	45	47.9
Hepatomegaly	60	45.1	45	47.9
Jaundice	20	15.0	13	13.8

Table 2. Duration of the disease

Duration	Amebic		Pyogenic	
	No.	%	No.	%
1~ 7day	53	41.1	32	34.8
8~14day	33	25.8	24	26.1
15~21day	14	10.9	9	9.8
21~28day	4	3.1	1	1.1
1~ 2 mo	13	10.2	13	14.1
2~ 3 "	7	5.5	7	7.6
3~ 4 "	2	1.6	3	3.3
5~12 "	2	1.6	3	3.3

conditions. Also 66 cases of the pyogenic abscess and 104 cases of the amebic abscess were admitted within one month and 5 patients were admitted within one year after onset (Table 2).

D. Laboratory Findings

1. Leukocyte count

Of the pyogenic abscesses, 17.9% of the patients showed no leukocytosis and 36.6% showed leukocytosis of 10,000~15,000/mm³ and 20.0% showed over 20,000/mm³. In the cases of amebic abscess, 26.3% of the patients showed no leukocytosis of 15,000~20,000/mm³ and 15.0% showed more than 20,000/mm³ (Table 3).

Table 3. W.B.C. count

W.B.C. \mm ³	Amebic		Pyogenic	
	No.	%	No.	%
Less than 10,000	35	26.3	16	17.8
10,000~15,000	38	28.6	32	35.6
15,000~20,000	40	30.1	18	20.0
More than 20,000	20	15.0	24	26.7

2. Liver Function Test

Liver function tests showed derangement of A/G ratio, alkaline phosphatase, and bilirubin while in the pyogenic abscesses and changes of alkaline phosphatase and B.S.P. in the amebic abscesses (Table 4).

Table 4. Liver function

Chemistry	Amebic		Pyogenic	
	No.	%	No.	%
Total protein	25	18.8	28	29.8
Reversed A/G ratio	57	42.9	42	44.7
Total bilirubin	25	18.8	38	40.0
Alk. phosphatase	69	51.8	40	42.6
B.S.P.	58	43.6	31	33.0
S.G.O.T.	18	12.8	12	12.8

E. X-ray Findings and Liver Scanning

1. X-ray findings

About 70% of the patients showed abnormal X-ray findings. Especially, elevation of the right

diaphragm was noted in 60.6% of the cases (Table 5).

Table 5. X-ray findings

Findings	No.	%
Elevation of Rt. diaphragm	91	60.6
Elevation of Rt. & Lt. diaphragm	9	6.0
Pleural adhesion	16	10.7
Subdiaphragmatic air	2	1.3
Linear atelectasis	15	10.0
Lower lobar pneumonia	17	11.0

2. Liver scanning

Liver scan was done in 59 cases, of which 57 cases showed a cold area which suggested liver abscess and the other 2 cases showed hepatic enlargement. Therefore liver scan showed 96.6 % positive findings and thus it can be said to be very important for the diagnosis and localization of liver abscess (Table 6).

Table 6. Results of liver scanning

Findings	Rt. lobe	Lt. lobe	Total
Cold area	50 84.7%	7 11.9%	57 96.6%
Reduced activity	18 30.5%	4 6.8%	22 37.3%

F. Immunological Test (Ameba immobilization test)

Amoeba immobilization test was done in 45 cases. 100% of those which showed ameba in the stool or in pus gave a positive reaction and 82.2% which showed chocolate colored pus gave a positive reaction.

In case of the pyogenic abscess only 5 cases out of 14 (35.7%) gave positive reaction (Table 7).

Table 7. Ameba immobilization test

	No.	Positive	Negative
Amebic abscess	45	37 (82.2%)	8 (17.8%)
Pyorenic abscess	14	5 (35.7%)	9 (64.3%)

G. Pathology and Bacteriologic Findings

1. Location of abscess

79 (83.6%) of the pyogenic abscesses were located in the right lobe and 12 (16.4%) were located in the left lobe. Out of 133 amebic abscesses 93.3% occurred in the right lobe and only 6.7% were located in the left lobe. The total number of hepatic abscesses was 227 and 89.3% of these proved to have an abscess in the right lobe and 10.7% in the left lobe.

Because of incomplete records, it couldn't be determined how many abscesses were single or multiple (Table 8).

Table 8. Location of abscess

Location	Amebic		Pyogenic		Total	
	No.	%	No.	%	No.	%
Rt. lobe	124	93.3	79	83.6	203	89.3
Lt. lobe	9	6.7	15	16.4	24	10.7

2. Bacteriologic or parasitologic exam.

E. coli was found in 39.5% of the pyogenic abscesses and then staphylococcus and streptococcus were found in that order. Pus culture showed no organisms in 27.6% of the pyogenic abscesses and 18.4% proved to be mixed infection (Table 9).

Table 9. Bacteriologic examination of pyogenic abscess

Organism	No.	%
E. coli	37	39.5
Staphylococcus, coagulase (+)	28	30.2
Staphylococcus, coagulase (-)	13	14.5
Alpha-hemolytic streptococcus	21	22.4
Aerobacter	9	9.2
Gram (-) bacilli	6	6.6
Mixed organism	17	18.4
No growth	26	27.6

In the amebic abscess, E. histolytica was found in the pus in 21 cases (15.7%) and 15 (11.8%) in the stool and 84.3% of the cases showed chocolate brown color or anchovy paste but no

Table 10. Parasitologic examination of amebic abscess

	No.	%
E. Histolytica in stool	15	11.8
E. Histolytica in pus	21	15.7
Sterile pus	112	84.3

ameba was found (Table 10).

H. Complications of Liver Abscess

Out of 94 cases of pyogenic abscess, complications occurred in 11 cases (11.7%) and out of 133 cases of amebic abscess 12 cases (9.0%) developed complications, so the over-all complication rate was 9.7%.

In pyogenic abscess, subphrenic abscess was found in 3 cases (3.2%), empyema thoracis in 3 cases (3.2%), peritonitis in 5 cases (5.3%). In amebic abscess 4 cases showed subphrenic abscess and peritonitis in the same person and 2 cases had empyema thoracis with peritonitis, 2 cases had subphrenic abscess and one case had bronchopleural fistula with empyema thoracis (Table 11).

Table 11. Complication of liver abscess

Type	Amebic		Pyogenic	
	No.	%	No.	%
Subphrenic abscess	7	5.3	3	3.2
Peritonitis	1	0.8	5	5.3
Empyema thoracis	3	2.3	3	3.2
Bronchopleural fistula	1	0.8	0	0
Total	12	9.0	11	11.7

I. Treatment

Primarily, the selection of antibiotics was based on the sensitivity test from the pus culture.

In amebic abscess emetine hydrochloride was injected subcutaneously daily for 7 to 10 days and the average dose was 1mg/kg of body wt. and the total amount did not exceed 700mg. Chloroquine was also used 1.0gm for the first 2 days and 0.5gm for the following 20 days

and the total amount did not exceed 21gm.

Recently Flagyl has begun to be used, 800 mg/day in divided doses for 10 days.

In addition, the E.C.G. was very helpful for the determination and clinical evaluation of the side effects of emetine.

In pyogenic cases open drainage was done in 59 cases (62.1%) aspiration in 35 cases (37.5%).

In amebic abscess open drainage was done in 29 cases (21.6%) and aspiration in 104 cases (78.4%) and in case of open drainage extraseous drainage was the principal method as far as possible (Table 12).

Table 12. Method of treatment

Abscess	Closed		Open	
	Cases	%	Cases	%
Amebic	104	78.4	29	21.6
Pyogenic	35	37.9	59	62.1

J. Prognosis and Mortality

Recovery period was relatively short for those who had no complications, but those who had complications required a long hospital period. For instances, 4 cases of pyogenic abscess, with hospitalization over 6 weeks were complicated by empyema thoracis. One case was complicated by bronchopneumonia and one was complicated by generalized Peritonitis and one case who had multiple abscess necessitated secondary drainage.

Table 13. Duration of hospitalization

Duration	Amebic		Pyogenic	
	No.	%	No.	%
1~7 day.	15	11.4	13	14.0
8~14	36	27.3	14	15.1
15~21	37	28.0	36	38.7
22~28	27	21.2	9	9.7
29~35	4	3.0	8	8.6
35~42	7	5.3	8	8.6
43~49	3	2.3	2	2.6
More than 50	3	2.3	3	3.2

For amebic abscess with no complications an average of 2 to 3 weeks hospitalization was necessary, but in complicated cases hospital course was prolonged (Table 13).

In those with pyogenic abscess 9 cases out of 94 expired. Two cases were complicated with generalized peritonitis due to rupture of empyema thoracis into the abdominal cavity. One case was complicated with subphrenic abscess and ascending cholangitis with hemorrhage.

In the amebic cases, 7 cases out of 133 (5.3%) expired. Of these one case was admitted 20 days after onset of symptoms and was already in a comatose state with deep jaundice. Three cases were complicated by subphrenic abscess and peritonitis and 2 cases were complicated by empyema thoracis and peritonitis. The over-all mortality out of 227 cases was 7.6% (Table 14).

Table 14. Mortality

	No.	%
Amebic	7/133	5.3
Pyogenic	9/94	9.6
Total	16/227	7.0

DISCUSSION

According to the etiologic agent, liver abscess can be classified as pyogenic or amebic, but an accurate diagnosis is not easy and there are many problems in treatment and prognosis.

The routes of pyogenic abscess development may be described as follows:

1. Ascending biliary tract infection.
2. Hematogenous infection via the portal system.
3. Septicemia following generalized dissemination via the hepatic artery.
4. Direct spread from peritonitis.
5. Other etiology including hepatic trauma.

Infection via the portal system had been the most common type before the antibiotic era. Kishner¹²⁾ reported that appendicitis was the most common etiologic factor and peptic ulcer perforation, cholecystitis, carbuncle, trauma and tonsillitis were the other causes.

Eliason⁵⁾ reported that of 47 causes of pyogenic liver abscess 47% were due to appendicitis.

Recently, many articles have reported that biliary tract disease, especially that due to biliary calculus and secondary inflammatory lesions following tumor, have been increasing causes of hepatic abscess.

Sherman and Robbins²¹⁾ pointed out some differences between Keeper¹¹⁾ and Ochsner & DeBailey¹⁶⁾ in that following the development of antibiotics the distribution, etiology and bacteriology have changed.

In Korea, K.Y. Lee & K.S. Sohn²⁵⁾ reported that liver abscess was accompanied by biliary tract infection and in this article the authors observed that pyogenic abscess followed cholecystitis in 6 cases and appendicitis in 3 cases.

Schwartz²⁰⁾ reported that out of 70 cases of pyogenic abscess 32 cases were due to biliary tract disease.

Kinney and Ferrebe¹³⁾ reported that obstruction of the common bile duct caused liver abscess in 25% of the cases.

In this report we can suppose that development of antibiotics has changed the etiological picture from appendicitis to cholecystitis.

DeBailey and Ochsner¹⁶⁾ report that amebic abscess is prevalent in the tropical zone. However Korea is in the temperate zone and amebic abscess is common, probably due to poor environmental hygiene.

Ludlow¹⁴⁾ pointed out similar facts in his report reviewing 100 cases and D.C. Kim²²⁾ and S.U. Hong²⁷⁾ reported that amebic abscess is

especially prevalent in Che-Ju Island area.

DeBakey and Ochsner⁴⁾ reviewed 263 cases of amebic liver abscess and suggest its development;

1. Via the portal system
2. Direct extension from intestinal wall or peritoneum
3. Via lymphatics.

They concluded that most of the infection occurred via the portal system. They also discussed the mechanism of abscess formation after the ameba reached the liver in the following 2 ways, first from intrahepatic portal thrombosis or infection and second by cytolytic activity of the amebae.

In this way, when the amebae entered via the portal vein they stayed in the portal venules, where they formed thrombotic infarcts and induced focal necrosis. Thus it makes probable a different pattern between pyogenic and amebic liver abscess.

Sex incidence showed male preponderance. In pyogenic abscess men outnumbered females 4 to 1 and in amebic abscess 5 to 1.

Sherman and Robbins²¹⁾ stated that one of the reasons for such male preponderance is alcohol and Rothenberg and Linder¹⁸⁾ agreed that males are more likely to be drunk or to get hurt.

Age distribution showed a peak at the 4th decade and the finding was similar to that of Rothenberg and Linder¹⁸⁾ Ochsner¹⁶⁾ and DeBakey⁴⁾ and I.S. Park²³⁾.

Recently, with the incidence of biliary disease as the etiologic factor for liver abscess, many articles have reported that increasing age today after 6th decade. Sherman and Robbins reported that out of his 130 cases 91% occurred in the 6th decade.

In our report, abdominal pain, fever and chills were prominent features and physical

examination showed hepatic enlargement and tenderness in the right upper quadrant.

Similar observations were made by Grigsby⁹⁾ DeBakey and Ochsner¹⁶⁾.

Leukocytosis was seen in over 50% and was more apparent in pyogenic abscess. In over 50% of the cases leukocyte count was 15,000/mm³. Grigsby reported that 70% of amebic liver abscess cases 10,000~18,000/mm³.

Blance¹ and Brem²⁾ reported a significant increase in alkaline phosphatase and BSP retention especially in amebic liver abscess.

In general, increased bilirubin levels, positive thymol turbidity, CFT and reversal of A/G ratio were seen.

The degree of liver function derangement was in reverse proportion to the recovery from liver abscess.

X-ray findings were that of an elevated right diaphragm due to liver enlargement, fixed diaphragm and secondary pleural thickening, lower lobar pneumonia, atelectasis or a free air shadow in the liver parenchyma.

Granger⁸⁾ reported 70~80% abnormal findings in X-ray films and Orgsky 70%, Ochsner and DeBakey⁴⁾ 82% and the authors found 67% and elevation of the right diaphragm was the most common finding.

Since Casson (1951) reported liver scanning using radioisotopes, Stirrette (1954) used Au⁻¹³¹ Rose Bengal with good results.

Shingleton (1966) reported over 90% accuracy using radioisotopes and we have observed a cold area in 96.6% of the cases.

According to Shuman¹⁹⁾ and Choi, In Kyu³⁾ its limitation in size for identification is 2.0cm in diameter. Location of the abscess was more common in the right lobe, being 83.6% of the pyogenic cases and 93.3% of the amebic cases and this is similar to our results.

According to Stewart²⁰⁾, *E. coli* was the most

common etiologic agent in pyogenic liver abscess and staphylococci and streptococci next in order.

Ochsner and DeBakey⁴⁾ report *E. coli*, streptococci and staphylococci in that order.

It is also well known that a large percentage of bacteriologic examinations of pus show no growth.

Rothenberg and Linder¹⁸⁾ report that 45.8% showed no growth on culture, Ochsner and DeBakey⁴⁾ 23%, K.H. Yoon²⁴⁾ 47.4% and 84.3% were negative in our study. In the cases of amebic abscess, amebae were found, 15.7% in pus and 11.8% in stool while 84.3% were negative on culture.

Ochsner and DeBakey⁴⁾ reported that on stool examination in the review of the literature 15% were positive but in his own series 45% were positive. In pus culture the literature showed 33% positive but 26% were positive in his series.

Goldman⁷⁾ report that it is helpful to identify amebae by using fluoresceintagged antibodies.

With the advent of antibiotics and various types of chemotherapy prognosis and mortality have much improved.

Dieulafoy(1898) reported almost 100% mortality in the early 19th century. Petren (1914) reported 95% and Otschkin¹⁷⁾ 80%. Ochsner¹⁶⁾ report 37.5% in single abscess and 95% mortality in the complicated cases.

Ochsner and DeBakey reported that mortality is dependent on the operative method. In cases of extracapsular drainage 33%, transpleural drainage 66.6% and transperitoneal drainage 72.7% mortalities were noted.

In our study mortality was 7.0%, I.S. Park²³⁾ reported 5.6%, D.H. Yoon²⁴⁾ 13.9% and C.S. Chung²⁶⁾ 16% mortality.

As for the prognosis of amebic liver abscess, Ochsner & DeBakey⁴⁾ summarized the factors

as follows;

1. Virulence of the organism.
2. Resistance of the host.
3. Stage of infection.
4. Complications.
5. Method of treatment.

They reviewed 263 cases in which mortality was 22.2%. Among these it was 11% for single abscess and 100% for multiple abscesses, 6.8% in uncomplicated cases and 42.9% in complicated cases, 5.5% in sterile pus, 4% in combined treatment with chemotherapy and aspiration, 22.2% in open drainage cases.

Ludlow¹⁴⁾ reported good results for morbidity and mortality in cases of open drainage with suitable chemotherapy.

In our study 5.3% mortality was seen in amebic abscess and 5.3% by I.S. Park, 7.5% by C.S. Chung, 10.6% by K.H. Yoon and 4.3% by Murray.

For the complications of liver abscess pleural involvement, a pneumonic process and generalized peritonitis due to ruptured abscess have been mentioned.

In our study 11.7% complications occurred in the pyogenic abscess and 16.6% in the series of I.S. Park²³⁾, and 25.3% in cases of Ochsner and DeBakey⁴⁾. Empyema thoracis on the right side was noted as by Sherman²¹⁾, 5.6% by I.S. Park²³⁾ and 3.2% by our study.

Peritonitis was noted as 8.2% to 28.8% in occidental reports, 2.8% in the cases of I.S. Park²³⁾ and 5.3% by the authors.

In the case of amebic abscess pleural involvement was noted as averaging 3~40% in occidental reports, 10% by I.S. Park²³⁾ and 8.2% by the authors. Peritonitis was reported as 9% by Ochsner¹⁶⁾, 5% by Ludlow¹⁴⁾, 5.4% in I.S. Park²³⁾ and 0.8% by the authors.

CONCLUSION

227 patients with hepatic abscess were admitted to Severance Hospital, Yonsei University Medical Center from July 1955 to June 1971 were analyzed and concluded as follows.

1. Among 227 cases of the hepatic abscess, 94(41.4%) were pyogenic abscess and 133(58.6%) were amebic abscess.

2. In the pyogenic abscess males outnumbered females in a 4:1 ratio and 5:1 in amebic abscess.

3. The peak age incidence for both groups came in the 3rd and 4th decade.

4. The most common clinical manifestations were pain and tenderness in the R.U.Q., hepatomegaly, fever and chills in both groups.

5. Positive roentgenologic findings on admission were present in 66.6% of both groups.

6. Liver scanning showed a cold area suggestive of liver abscess in 57 cases of the 59 studied (96.6%).

7. The right lobe of the liver was involved 83.6% of the pyogenic and 93.3% of the amebic abscess.

8. In direct smear and culture studies the pus was found to be sterile in 27.6% of the pyogenic abscess and the most frequently found organisms were E. Coli and staphylococcus.

9. In the amebic abscess ameba was found in the pus in 15.7% and only 11.8% had cysts in their stools.

10. The incidence of complications was 11.7% in the pyogenic and 9.0% in the amebic abscess.

11. The mortality rate for both groups was 7.0%, 9.6% in the pyogenic and 5.3% in the amebic abscess.

REFERENCES

- Blanc, F.: *Hepatitis amebienne*, *Zeitschr. F.F. Path. U. Bakt.*, 16:559, 1953.
- Brem, T.H.: *The use of hepatic function test in the diagnosis of the amebic abscess of the liver*. *Am. J. Med. Sci.*, 229:153, 1955.
- Choi, I.K.: *Observation of liver color scan*. *K.J. of Nucl. Med.*, 3:55, 1969.
- DeBakey, M.E. Ochsner, A.: *Hepatic amebiasis. A 20 year experience and analysis of 263 cases*. *Internat. Abstracts of Surg.* 92:209, 1951.
- Eliason, E.L., Brown, R.B. and Anderson, D.P., Jr.: *Pyogenic liver abscess*. *Pennsylvania M.J.*, 41:1147, 1938.
- Friedel, H.L. and Macintyre, W.J.: *A method for the visualization of the configuration and structure of the liver*. *J. Roentg.* 77:455, 1957.
- Goldman, M.: *Use of fluorescein-Ragged Antibody to identify cultures of endameba histolytica and endameba coli*. *Am. J. Hyg.*, 59:318, 1954.
- Granger, A.: *Radiological sign of subdiaphragmatic abscess new orleans*. *M. & S.J.*, 82:748, 1930.
- Grigsby, W.B.: *Surgical treatment of amebiasis*. *S. G.O.* 128:609, 1969.
- Jordan, P.H.: *Treatment of amebic abscess of the liver by open surgical drainage*. *Ann. Surg.*, 141:70, 1955.
- Keefer, O.S.: *Liver abscess: Review of 85 cases*. *N. E.J.M.*, 211:21, 1934.
- Kisner, W.H.: *Solitary pyogenic abscess of the liver*. *Am. J. Surg.*, 73:510, 1947.
- Kinney, T.D. & Ferrebee, J.W.: *Hepatic abscess factors determining its location*. *A.M. Arch. Path.* 45:41, 1948.
- Ludlow, A.I.: *Liver abscess. report of one hundred operations*. *S.G.O.* 36:336, 1923.
- Murray, F.J., P.K.: *Amebic liver abscess*. *Cand. Med. J.* 26:312, 1932.
- Ochsner, A. & DeBakey, M.E.: *Pyogenic abscess of the liver. An analysis of 47 cases with review of the literature*, *Am. J. Surg.* 40:292, 1938.
- Otschkin, A.D.: *Thrombosis of the mesenteric veins*

- and of the portal veins in appendicitis. Arch. F. Klin. Chir., 171:758, 1932.*
- Rothenberg, R.E. & Linder, W.: *Single pyogenic liver abscess, 24 cases. S.G.O. 59:31, 1934.*
- Schuman, B.N., Block, M.A., Eyler, W.R. & Dusault, L.: *Liver abscess: Rose bengal 1131 hepatic photoscan in diagnosis and management. J.A. M.A. 187:708, 1964.*
- Schwartz, S.I.: *Hepatic abscesses, surgical disease of the liver, 1964. McGraw-hill book co. new yor, p.143.*
- Serman, J.D., and Robben, S.L.: *Changing trends in the caustics of hepatic abscesses. Am. J. Med., 28:943, 1960.*
-