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The Changing Patterns of Liver Abscess During the Past 20 Years
—A study of 482 cases—

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The diagnostic and treatment modalities of liver abscess have developed rapidly over the past few years but morbidity and mortality has not been markedly reduced. A total of 482 cases of liver abscess admitted to the Yonsei Medical Center over the past 20 years(Jan. 1971-Dec. 1990) were divided into 261 cases from the 1970s and 221 cases from the 1980s and the clinical and laboratory parameters were analyzed comparatively to determine if the clinical features, therapies and prognosis of liver abscess had changed. The proportion of amebic relative to pyogenic liver abscess decreased. Transbiliary infections increased in pyogenic liver abscess of the 1980s. Clinical signs such as jaundice and hepatomegaly and symptom duration before admission decreased. Abnormal laboratory features including hypoalbuminemia and elevation of alkaline phosphatase decreased and increased, respectively, in the 1980s. Ultrasonically guided percutaneous aspiration was the choice of treatment instead of surgical drainage in the 1980s. Despite diagnostic and therapeutic advances in the management of liver abscess, the prognosis has not improved in the 1980s as compared to the 1970s. This may reflect an increase in the incidence of liver abscess in old aged patients and patients with diabetes mellitus or underlying malignancy in the 1980s.

Key Words: Liver abscess, Amebic, Pyogenic, Changing patterns

Liver abscess has been described since ancient times. Early diagnosis is still difficult despite recent developments in diagnostic modalities such as the radioisotope scan, ultrasonography and computerized tomography(CT). In addition, the use of antibiotics and surgical drainage of the abscess have not markedly improved the prognosis. As ultrasonography and CT gained widespread use in the 1980s, percutaneous aspiration was favored over surgical drainage. These and other developments in hygiene and the health system in general led us to believe that there would be a difference in the clinical presentation of liver abscess in a given period, such as between the 1970s and the 1980s. We compared the etiology, clinical features, therapeutic modalities and prognosis of 261 patients of the 1970s and 221 patients of the 1980s who were diagnosed with liver abscess at the Yonsei Medical Center between Jan. 1971 to Dec. 1990.

PATIENTS AND METHODS

We analyzed 482 cases of liver abscess admitted to the Yonsei Medical Center during the 20 year period, Jan. 1971 - Dec. 1990. These cases were subdivided into two periods, the first was 261 cases diagnosed during 1971 to 1980, and the second was 221 cases diagnosed during 1981 to 1990.

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The diagnostic criterion of liver abscess were 1) Confirmation of cavitary lesions in the liver by operation or the imaging diagnostic method, and 2) Demonstration of pus by surgical drainage or percutaneous aspiration. Pyogenic liver abscess was the diagnosis if the above criteria was fulfilled with a bacteriologic study being positive in the blood or aspiration fluid, or if pyogenic inflammation was revealed on a histologic examination of the abscess wall. Amebic liver abscess was the diagnosis if the following were present: 1) Presence of amebic protozoa in the drainage fluid or biopsied wall of the abscess or 2) A negative bacteriologic study of the blood and drainage fluid with a strong positive serology for ameba. When features of amebic and pyogenic abscess coincided, it was classified as a mixed type. Abscesses which did not belong to any of the above categories were classified into the unknowns.

The age, sex, symptoms, signs, laboratory data, imaging modality, characteristics of the abscess cavity, microbiologic study, associated diseases, route of infection, treatment, complications and prognosis were reviewed. The results were statistically compared for pyogenic and amebic liver abscess and for the difference between the two periods. The age, duration of symptom, number and diameter of abscess were analyzed using the Student *t*-test and all other parameters were analyzed by the X^2 test.

RESULTS

Etiology of liver abscess

The causes of liver abscess were as follows; Of the 261 cases during the 1970s there were 100 cases of amebic (38%), 68 cases of pyogenic (26%), 8 cases of mixed (3%) and 85 cases of unknown (33%); Of the 221 1980s' cases there were 48 cases of amebic (22%), 110 cases of pyogenic (50%), 4 cases of mixed (2%) and 59 cases of unknown (27%). Pyogenic liver abscess increased and amebic liver abscess decreased significantly in the 1980s ($p<0.01$)(Fig. 1, Fig. 2).

Demography

The male to female ratio was 2.2 : 1 and the average age was 44.3 years in the 1970s and 48.7 years in the 1980s. The prevalent age interval was the 4th decade for amebic abscess and the

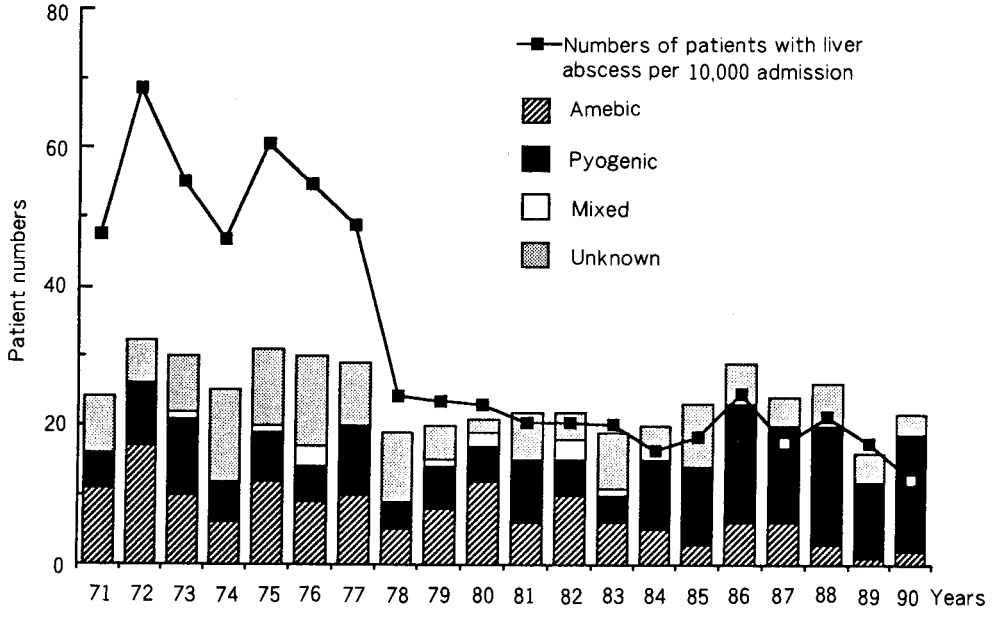

Fig. 1. *Annual incidence of liver abscess.*

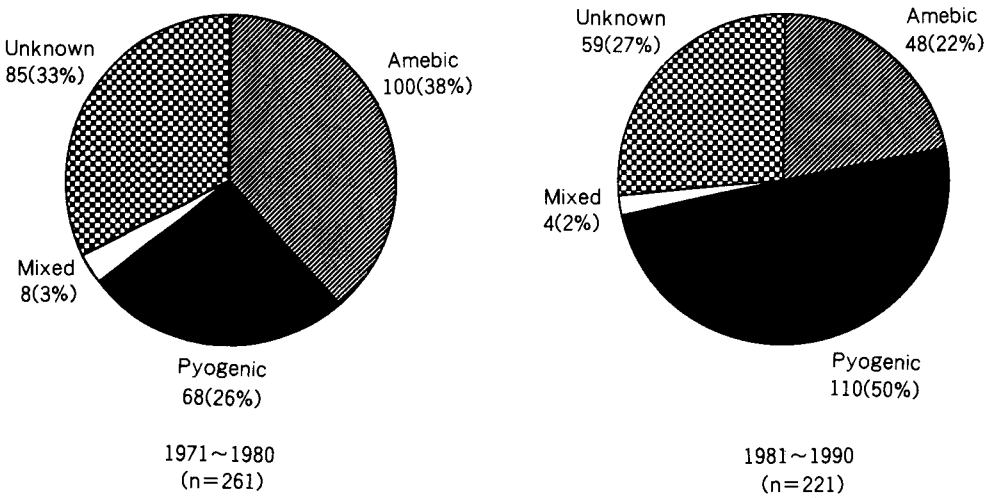

Fig. 2. *Etiologies of liver abscess.*

Table 1. Age and sex distribution

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Mean age(years)	42.9	46.2	44.3[a]	45.9	50.0	48.7[a]
Sex(M:F)	3.5:1[b]	1.2:1[b]	2.6:1	3.8:1[c]	1.4:1[c]	2.1:1

[a, b, c] $p<0.01$

5th decade for the pyogenic abscess. The abscess of the 1980s and pyogenic abscess occurred at an older age ($p<0.01$)(Table 1, Fig. 3).

Annual incidence

Number of liver abscess patients admitted to the Yonsei Medical Center ranged from 17 to 32 annually. The percentage of liver abscess among the hospital population decreased from 0.45% in the 1970s to 0.19% in the 1980s (Fig. 1).

Clinical features

The main clinical symptoms were abdominal pain, fever and chilling, nausea and vomiting, general weakness and diarrhea in descending order. Diarrhea was more frequent in amebic abscess and cases representing the 1970s. The duration of symptoms before admission tended to be shorter in the 1980s (13.8 days) than in the 1970s (20.1 days). On physical examination, abdominal tenderness and hepatomegaly were observed with high frequency but jaundice and hepatomegaly were less common in the 1980s than in the 1970s ($p< 0.01$)(Table 2).

Laboratory findings

The laboratory data is summarized in Table 3. Anemia, leukocytosis and thrombocytopenia were the common abnormal findings on peripheral blood smears. Abnormal liver function test values were hypoalbuminemia and elevation of serum alkaline phosphatase. Abnormal laboratory features included hypoalbuminemia and

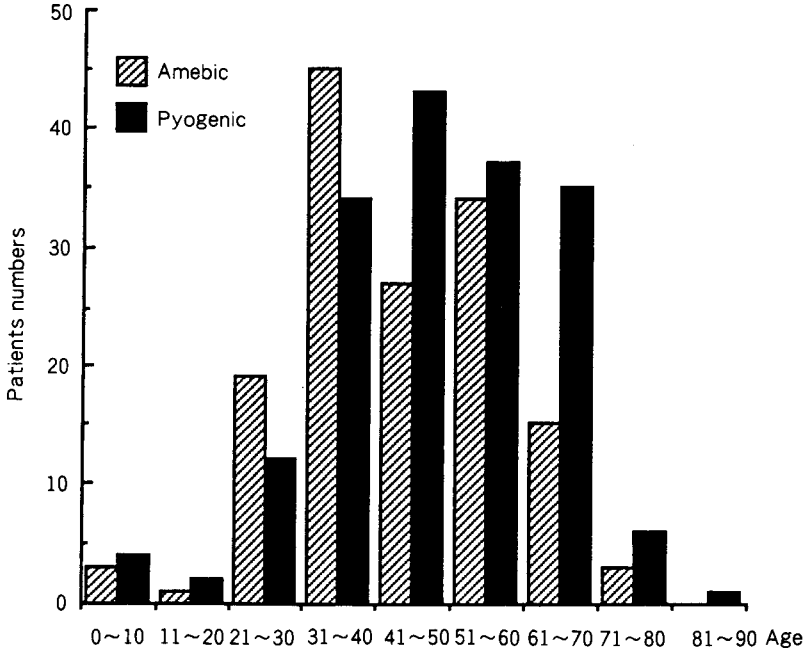

Fig. 3. *Age distribution of liver abscess.*

Table 2. Clinical manifestations

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Symptoms						
Fever/Chilling	70%	68%	69%	63%	75%	71%
Abdominal pain	82%	90%	85%	90%	84%	85%
Nausea/Vomiting	26%	29%	27%	8%	30%	23%
Weakness	24%	18%	21%	15%	25%	22%
Diarrhea	28%	16%	23%[a]	15%	13%	13%[a]
Weight loss	23%	25%	24%	13%	17%	16%
Duration of Symptom(days)	22.4±39.0	16.7±17.8	20.1±32.3	17.9±24.7	12.2±11.0	13.8±15.8
Sings						
Fever(>37.3℃)	90%	97%	93%	92%	94%	93%
RUQ tenderness	88%	91%	89%	88%	88%	88%
Hepatomegaly	68%[c]	65%[c]	67%[d]	40%[b]	42%[c]	41%[d]
Jaundice	24%[e]	26%[f]	25%[g]	2%[e]	9%[f]	7%[g]

[a] $p<0.05$

[b, c, d, e, f, g] $p<0.001$

Table 3. Laboratory data on admission

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Leukocytosis(>10×10^9/L)	82%	74%	78%	88%	81%	83%
Anemia(<10 g/dl)	27%	25%	26%	17%	25%	23%
Thrombocytopenia(<150×10^9/L)	22%	52%	36%	10%[a]	31%[a]	25%
Albumin(<3.0 g/dl)	66%	71%[b]	68%[c]	71%[d]	49%[bd]	55%[c]
T.Bilirubin(>2.0 mg/dl)	13%[e]	40%[e]	24%	10%	25%	22%
Alkaline phosphatase(>115 IU/L)	56%	53%[f]	55%[g]	76%	86%[f]	83%[g]
AST(>60 IU/L)	27%	42%[h]	33%[i]	11%	25%[h]	21%[i]
ALT(>60 IU/L)	12%	24%	17%	10%	25%	20%
Prothromibn-time(<70% of control)	19%[j]	6%[j]	14%	19%	12%	14%

[a, c, d, h, i, j] $p<0.05$
[b, e, f, g] $p<0.01$

Table 4. Positive serology studies in amebic liver abscesses

	1971~1980 (n=48)	1981~1990 (n=42)
Indirect Hemagglutination(IHA)[a]	97%	93%
Indirect Fluorescent antibody(IFA)[b]	100%	95%

[a]IHA positive; ≥ 1:512
[b]IFA positive; ≥ 1:16

elevation of alkaline phosphatase which were significantly decreased ($p<0.05$) and increased ($p<0.01$), respectively, in the 1980s.

Serologic tests for ameba

Serologic tests for ameba were performed using indirect hemagglutination (IHA) and indirect fluorescent antibody (IFA). The cut off values were 512 for IHA and 16 for IFA. More than 90% of amebic liver abscess showed positive for IHA or IFA. Examination of drained fluid from amebic abscess revealed amebic trophozoites in only 10 cases (18%)(Table 4).

Microbiology

Pus culture of pyogenic liver abscess was positive in 120 patients (82%) among 146 patients. 213 organisms were isolated from the 120 patients, with a prevalence of gram (−) bacilli. *E coli* was the most frequently found organism (30%). Other common organisms were *Klebsiella* (13%), *Proteus* (9%), *Staphylococcus coagulase positive* (8%) and *α-Streptococcus* (6%). Anaerobes were cultured in 12% of the pyogenic abscesses. Blood culture was positive in 60 (42%) of 143 patients with *E coli* being the most common isolate (Table 5).

Imaging studies

The sensitivity of all imaging studies including the radioisotope scan, ultrasonography and CT was in excess of 90%. Ultrasonography and CT gained more frequent use in the 1980s (Table 6).

Multiplicity and lobar distribution

The mean number of abscesses was 1.1 in the 1970s, 1.2 in the 1980s. The mean size decreased significantly from 7.9 cm in the 1970s to 6.2 cm in the 1980s ($p<0.05$). Multiplicity and left lobe involvement was more common in abscesses of pyogenic origin ($p<0.05$)(Table 7).

Associated diseases

Commonly associated diseases were diabetes mellitus, malignancy, liver cirrhosis and pyelonephritis. Diabetes mellitus and malignancy increased in the 1980s as compared to the 1970s (Table 8).

Table 5. Microorganisms in pyogenic liver abascesses

	Drained fluid			Blood		
	1971~1980 (n=68)	1981~1990 (n=110)	Total (n=178)	1971~1980 (n=68)	1981~1990 (n=110)	Total (n=178)
No. of cultures taken	50	96	146	50	93	143
No. of positive(%)	46(92%)	74(77%)	120(42%)	21(42%)	39(42%)	60(42%)
No. of organisms	85	128	213	24	55	79
Gram positive aerobes	17(20%)	35(27%)	52(24%)	10(42%)	17(31%)	27(34%)
Alpha streptococci	4	9	13	2	4	6
Beta streptococci	–	–	–	–	1	1
Enterococci	4	8	12	–	5	5
Streptococci viridans	1	8	9	–	3	3
Staphylococci coag(−)	1	–	1	5	2	7
Staphylococci coag(+)	7	10	17	3	2	4
Gram negative aerobes	61(72%)	74(59%)	135(64%)	14(58%)	32(58%)	46(59%)
E. coli	27	36	63	9	16	25
Proteus	7	12	19	1	1	2
Pseudomonas	3	1	4	1	2	3
Klebsiella	10	18	28	–	3	3
Agrobacter	2	–	2	–	1	1
Enterobacter	7	2	9	1	4	5
Serratia	–	–	–	1	1	2
Morganella	–	3	3	–	1	1
Citobacter	2	1	3	1	–	1
Aeromonas	–	–	–	–	1	1
Providencia	–	–	–	–	1	1
Salmonella	1	1	2	–	–	–
Shigella	–	–	–	–	1	1
Acinetobacter	2	–	2	–	–	–
Gram positive anaerobes	6(7%)	3(2%)	9(4%)	–	1(2%)	1(1%)
Peptostreptococci	6	–	6	–	1	1
Streptococci fragilis	–	1	1	–	–	–
Clostridia	–	2	2	–	–	1
Gram negative anaerobes	1(1%)	15(12%)	16(8%)	–	5(9%)	5(6%)
Bacteroides fragilis	1	14	15	–	4	4
Fusobacterium	–	1	1	–	1	1

Table 6. Diagnostic rate of imaging studies

	No. positive/total number of test(%)	
	1971~1980	1981~1990
Radioisotope scan	208/215(97%)	92/97 (95%)
Ultrasonography	8/10 (80%)	187/202(93%)
Computerized tomography	–	70/74 (95%)

Route of infection

The most common origin of pyogenic liver abscess was transbiliary infection, and its frequency significantly increased from 31% in the 1970s to 51% in the 1980s ($p<0.05$)(Table 9). Antecedent symptoms of intestinal amebiasis were noted in 18% of amebic liver abscesses.

Treatment

Open surgical drainage was performed in 141

Table 7. Lobar distribution, mutiplicity and size

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Multiplicity	21%[a]	41%[a]	29%	23%[b]	33%[b]	28%
Mean numbers	1.2±1.1	1.0±0.2	1.1±0.9	1.2±0.4	1.2±0.6	1.2±0.6
Location						
Right lobe	84%	65%	75%	81%	64%	69%
Left lobe	12%[c]	19%[c]	16%	11%[d]	24%[d]	20%
Both lobe	4%	16%	9%	8%	12%	11%
Size						
0~ 5 cm	29%	29%	29%	26%	53%	45%
6~10 cm	63%	57%	61%	65%	44%	50%
>10 cm	8%	14%	10%	9%	3%	5%
Mean diameter(cm)	8.1±3.8	7.4±4.5	7.9±4.0[e]	7.3±2.9	5.7±2.9	6.2±2.9[e]

[a, b, c, d, e] $p<0.005$

Table 8. Associated diseases

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Diabetes mellitus	2%	1%[a]	2%[b]	4%	22%[a]	17%[b]
Malignancy	1%	7%	3%	2%	11%	8%
Liver cirrhosis	2%	6%	4%	2%	6%	5%
Pyelonephritis	1%	7%	3%	–	–	–

[a, b] $p<0.05$

Table 9. Routes of infection

	1971~1980	1981~1990
Amebic(n=148)		
Portal	18%	19%
Cryptogenic	82%	81%
Pyogenic(n=178)		
Biliary[a]	31%	51%
Hematogenous	10%	3%
Operation/Trauma	7%	2%
Portal	6%	2%
Tumor	4%	2%
Direct	1%	2%
Cryptogenic	40%	38%

[a] $p<0.05$

cases (29%) and percutaneous aspiration drainage in 300 cases (62%). Aspiration drainage was used more frequently in the 1980s. All cases were blindly aspirated during the 1970s but 137 cases (87%) were aspirated under the ultrasonographic guidance in the 1980s (Table 10).

Complications

The incidence of complications was 63%. The common complications were pulmonary (56%), acute renal failure (8%), peritonitis (7%) and subphrenic or subhepatic abscess (6%). The incidence of complications did not differ between the causes or between the periods (Table 11).

Table 10. Treatment modality

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Operation	42%	56%	48%[a]	15%	23%	21%[a]
Aspiration	58%	44%	52%[b]	85%	77%	79%[b]
Blind	100%	100%	100%	15%	12%	13%
US[c] guided	–	–	–	85%	88%	87%

[a, b] $p<0.01$
[c] ultrasonography

Table 11. Complications

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Pulmonary	62%	53%	58%	44%	57%	53%
Renal failure	6%	13%	9%	2%	8%	6%
Subphrenic or subhepatic abscesses	3%	12%	7%	4% 4%	6%	5%
Rupture with peritonitis	5%	13%	8%		5%	5%
Total	62%	74%	67%	44%	66%	59%

Table 12. Mortality and recurrence

	1971~1980			1981~1990		
	Amebic (n=100)	Pyogenic (n=68)	Total (n=168)	Amebic (n=48)	Pyogenic (n=110)	Total (n=158)
Recurrence	3%	7%	5%	4%	11%	9%
Mortality	4%[a]	19%[a]	10%	2%[b]	15%[b]	11%

[a, b] $p<0.01$

Mortality and recurrence

The overall mortality rate was 11%, which was not different between the two periods. However the mortality of pyogenic liver abscess (17%) was significantly higher than that of amebic liver abscess (3%)($p<0.01$). The recurrence rate was 7% for all cases (Table 12).

DISCUSSION

Liver abscess was described by Hippocrates since antiquity. The classical study of liver

abscess was done by Ochsner *et al.* (1938). During the course of time, public sanitation improved, the population aged, radiological diagnostic modalities developed, antibiotics and effective draining methods of abscesses appeared. Many studies on liver abscess have reported considerable changes in clinical features, associated diseases, causative agents, treatment modalities and prognosis due to the above developments. Currently, there is concern about the delayed diagnosis of liver abscess due to an obscuring of clinical features by indiscriminate use of antibiotics and increasing incidence in critically ill patients.

Oschner *et al.* (1938) reported that of the 186 liver abscess patients that he encountered, amebic and nonamebic causes accounted for 75 % and 25%, respectively. But studies done after the 1970s have revealed that pyogenic liver abscess is the leading cause of abscesses occupying 78~93% of all cases (Altemeier *et al.* 1970; Rubin *et al.* 1974; Cohen and Reynolds 1975; Greenstein *et al.* 1985). In our study, the proportion of pyogenic liver abscess increased from 26 % in the 1970s to 50% in the 1980s.

The overall prevalence of liver abscess among hospital admissions was high in our study with 0.32% more than figures reported from other countries (Ochsner *et al.* 1938; Rubin *et al.* 1974; Pitt and Zuidema 1975; Greenstein *et al.* 1984); nevertheless our data showed that the overall incidence of liver abscess was decreasing from 0.45% in the 1970s to 0.19% in the 1980s.

Generally pyogenic liver abscess occurs at an older age than dose amebic liver abscess (Barbour and Juniper 1972; Cohen and Reynolds 1975; Greenstein *et al.* 1985) and this was the case in our study. The abscesses of the 1980s developed at an older age which was probably due to an increasingly aged population and relatively high incidence of pyogenic liver abscess in the 1980s.

The laboratory features of liver abscess were nonspecific with common findings being hypoalbuminemia, anemia and leukocytosis with a leftward shift, which suggested chronic debilitation and inflammation (Lazarchick *et al.* 1973; Rubin *et al.* 1974). Other reports showed that alkaline phosphatase levels were increased in 78~90% of pyogenic liver abscess especially in association with biliary obstruction. In our study, alkaline phosphatase was increased in 74 % of pyogenic liver abscess and it was more evident in cases representing the 1980s, reflecting an increased association with biliary obstruction.

Serological studies consisting of IHA (indirect hemagglutination) and IFA (indirect fluorescent antibody) were highly sensitive and specific as much as 90~100% for amebic infestations (Barbour and Juniper 1972; Patterson *et al.* 1980; Abuabara *et al.* 1982). However the antibodies persisted for more than 3 years after amebiasis. In this study, the positive rates were 95% for IHA and 97% for IFA.

Microbiology of pyogenic liver abscess has changed recently due to the development of culture techniques and the prediagnostic use of antibiotics. In the 1930s, Ochsner *et al.* (1938) reported that common organisms causing pyogenic liver abscess were *E coli*, *Streptococcus* and *Staphylococcus*. However, after the appearance of antibiotics such as sulfonamides, penicillins and streptomycins during the 1930s to the 1950s, drug resistant gram negative bacilli became the dominant pathogens. *E coli* was the most commonly isolated organism in the majority of studies ranging from 37% to 65% in pyogenic liver abscess (Butler and McCarthy 1969; Lazarchick *et al.* 1973; Rubin *et al.* 1974; Greenstein *et al.* 1984; McDonald *et al.* 1984; Greenstein 1985; Branum *et al.* 1990). Frequent organisms found in our study were *E coli* (30%), *Klebsiella* (13%) and *Proteus* (9%). Overall the majority of organisms were gram negative bacilli (64%). Negative cultures were obtained in the range of 8% to 38% in various other studies (Ochsner *et al.* 1938; Lazarchick *et al.* 1973; Rubin *et al.* 1974; Pitt and Zuidema 1975; McDonald *et al.* 1984; Swallow and Rotstein 1990). Failure to isolate organisms probably resulted from the failure to culture the abscess for anaerobic organisms as well as previous antibiotic therapy (McDonald *et al.* 1984). The proportion of anaerobes isolated has increased to 20-45% with improved methods of transporting anaerobic material and culture techniques (Sabbaj *et al.* 1972; Greenstein *et al.* 1984; Miedema and Dineen 1984; McDonald *et al.* 1984). The commonly isolated anaerobes were *Bacterioides*, *Fusobacterium* and *Microaerophilic streptococcus (S. milleri)*.

The radioisotope scan which has been performed since the 1960s has a diagnostic accuracy of about 70~95% (Ochsner *et al.* 1938;

Lazarchick *et al.* 1973; Rubin *et al.* 1974; Pitt and Zuidema 1975; Satiani and Davidson 1978; McDonald and Howard 1980). It can detect lesions as small as 2 cm in size. The sensitivity of imaging studies for liver abscess are 80~90% for ultrasonography, and 90-100% for CT. Our study showed that the sensitivity of all imaging studies including radioisotope scan, ultrasonography and CT was in excess of 90%. Greenstein *et al.* (1984) cited that the advent of ultrasonography and CT had resulted in earlier diagnosis followed by immediate drainage, with consequent reduction in the mortality rate of liver abscess. Moreover, an abscess demonstrated by ultrasound or radionuclide scan, required CT to accurately define the number and site of other abscesses (Greenstein 1985).

In pyogenic liver abscess, it is reported that multiplicity occurs in 44~66%, with both lobe involvement in 10~30% (Ochsner *et al.* 1938; Lee and Block 1972; McDonald and Howard 1980; Miedema and Dineen 1984; Greenstein *et al.* 1984). Our study showed multiplicity in 36%, right lobe involvement in 64% and both lobes involvement in 14% of the cases. The average of the longest measured diameter of the abscess cavity was 7.4 cm in the 1970s and 5.7 cm in the 1980s with the average number of cavities being 1.0 and 1.2 respectively. This meant that pyogenic liver abscess tended to decrease in size and increase in number in the 1980s suggesting that multiple abscess from ascending cholangitis increased in the 1980s. Our results showed that multiplicity and right lobe involvement was lesser in amebic liver abscess.

Association of diabetes mellitus with liver abscess has been noted in the range of 8% to 16 % (Greenstein *et al.* 1984; Miedema and Dineen 1984; McDonald *et al.* 1984). In our study, diabetes was more frequently associated with liver abscess in the 1980s (17%) compared to the 1970s (2%). Recent studies report that the association of malignancy with liver abscess range from 13% to 31% (Pitt and Zuidema 1975; Miedema and Dineen 1984; McDonald *et al.* 1984; Branum *et al.* 1990). In our case, malignancy had a 3% incidence in the 1970s but 8% in the 1980s.

In studies conducted before 1928, liver abscess of portal origin were abundant (36%), however, the incidence of bacterial seeding of the liver from portal circulation has markedly decreased in recent years due to the introduction of broad spectrum antibiotics and aggressive surgical management of intra-abdominal infections (Ochsner *et al.* 1938; Miedema and Dineen 1984). Today, biliary tract diseases are the most common cause of liver abscess and its incidence range from 26% to 44% (Lazarchick *et al.* 1973; Greenstein *et al.* 1984; Miedema and Dineen 1984; Greenstein 1985). The causes for the increase in transbiliary infections were the increasing age of incidence with concurrent malignancy and a relative decrease in transportal infections (Mcdonald and Howard 1980). In our series, transbiliary infection was the most common source of pyogenic liver abscess and it was more prevalent in the 1980s.

Treatment of pyogenic liver abscess has changed notably over the past 20 years (McDonald *et al.* 1984). Some authors reported successful treatment with antibiotics alone in about half of the patients (Maher *et al.* 1979; Herbert *et al.* 1982), but most agree that drainage and concomitant antimicrobial chemotherapy are essential for successful treatment (Ochsner *et al.* 1938; Lazarchick *et al.* 1973; Pitt and Zuidema 1975; Miedema and Dineen 1984; Greenstein 1985). McFadzean *et al.* (1953) successfully treated 13 of 14 patients using percutaneous drainage and antibiotics. After the mid 1970s, ultrasonically guided percutaneous aspiration has been safely performed and thereafter many studies have revealed that percutaneous aspiration guided by ultrasonography was equal or superior to surgical drainage (Smith and Bartrum 1974; Haaga and Weinstein 1980; Kraulis *et al.* 1980; Martin *et al.* 1981; vanSonnenberg *et al.* 1982; Sheinfeld *et al.* 1982; Fischer and Beaton 1983; Gerzof *et al.* 1985; Swallow and Rotstein 1990). Gerzof *et al.* (1981) described that percutaneous drainage had the advantage of being highly successful with low morbidity and better patient acceptance. He suggested that percutaneous drainage should be considered before operative intervention in all patients with liver abscess (Adams and MacLeod 1977; Haaga and Weinstein 1980; Martin *et al.* 1981; Sheinfeld *et al.* 1982; Gerzof *et al.* 1985; Branum *et al.* 1990). Surgical drainage was reserved for failure of percutaneous drainage (Swallow and Rotstein 1990). In our study, percutaneous drainage was more commonly used for the treatment of pyogenic liver abscess in the 1980s. The mortality rate was not significantly different between operative and percutaneous drainage (11% versus 16%). However,

the majority of critically-ill patients with pyogenic liver abscess were treated by percutaneous instead of surgical drainage.

Earlier diagnosis with consequent earlier drainage results in higher survival, but may be associated with an increase in complications (Lee and Block 1972; Pitt and Zuidema 1975; Greenstein *et al.* 1984). Complications occured in 31% in an earlier series of Ochsner *et al.* (1938) but at present the incidence ranges from 44% to 57% as reported by several authors (Pitt and Zuidema 1975; Miedema and Dineen 1984). Pleuropulmonary problems were predominant among the complications (Ochsner *et al.* 1938; Pitt and Zuidema 1975).

Although there is a general agreement that amebic liver abscess can obviously be cured by administration of systemic amebicides (Cohen and Reynolds 1975; Abuabara *et al.* 1982), percutaneous drainage is recommended for a large abscess in the left lobe, for failed metronidazole therapy and for suspected bacterial superinfection (Barbour and Juniper 1972; Ribaudo and Oschner 1973; Adams and MacLeod 1977; Ibarra-Perez 1981; Abaubara *et al.* 1982).

The mortality rate of pyogenic liver abscess was reported to be around 80% of the 433 collected cases by Ochsner *et al* (1938), but recently it has varied from 19% to 53% (Lazarchick *et al.* 1973; Satiani and Davidson 1978; Fischer and Beaton 1983; Greenstein 1985; Branum 1990). Amebic liver abscess is clinically more benign than pyogenic liver abscess, and has a better prognosis. Adams and MacLeod (1977) found a 0.7% mortality for uncomplicated amebic liver abscess compared with 29.6% for amebic liver abscess with extension into the pericardium. In our study, the mortality was lower for amebic abscess than pyogenic abscess, 3% versus 17%. However, there was no significant difference in mortality rates between the 1970s and 1980s.

Despite improvements in diagnostic methods and modes of treatment after the 1980s, the prognosis has not improved in the 1980s as compared with the 1970s. This may reflect an increase in the incidence of liver abscess in old aged patients and patients with diabetes mellitus or underlying malignancy in the 1980s.

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