



## Research Article

# Clinical Study of Prognostic Factors in Patients with Pyogenic Liver Abscess at G.R. Medical College and J.A. Group of Hospitals

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## Abstract

**Objective:** To describe pyogenic liver abscess with respect to demography, clinical signs and symptoms, microbiological features, mode of treatment and adverse prognostic factors

**Background:** Pyogenic liver abscesses are the most common liver abscesses and has been recognized since the time of Hippocrates. Patients commonly present with right upper quadrant pain and fever. Jaundice occurs in up to one third of affected patients. Pyogenic liver abscess (PLA) is an uncommon but potentially life-threatening disorder with a crude annual incidence rate worldwide ranging from 2 to 45 cases per 1,00,000 hospital admissions. Because previous reports of patients with PLA have seldom included bacterial characteristics, we will collect microbiological data and other clinical information from PLA patients to identify the prognostic factors for this condition. We will also investigate the clinical features, abscess characteristics, causative pathogens, treatments and outcomes in these patients over this study period.

**Methods:** This prospective study involved 150 patients who were admitted in male and female surgical wards, Department of General surgery, J.A. Group of hospitals and G.R. Medical College, Gwalior during period December 2017-August 2019.

**Results:** The mean age was 44 years (ranging from 16 to 80 years). Out of these 150 patients, 140 patients were male and 10 patients were female ranging from 16 to 80 years with male to female ratio 14:1. The mean duration of symptoms prior to admission was 5.2 days (median – 3 days, range 1-60 days). The most common presenting feature was right upper quadrant abdominal pain – 96.6% followed by fever with chills 74%. Co-morbidities included were hypertension, diabetes mellitus, old stroke, ischaemic heart disease and congestive heart failure. 48 (32%) patients had diabetes mellitus, while 45(30%) patients had 2 or more co-morbid illness. Total bilirubin was elevated in 19 patients (12.7%). 131 patients (87.3%) had normal serum bilirubin level. The most common organism identified was E-coli (33.3% in pus culture and 20% in blood culture) followed by klebisella (25% in pus culture and 13.3% in blood culture).

**Conclusion:** Patients who are treated with antibiotics only are the ones having the abscess cavity size less than 5 cm. In pyogenic liver abscess patients having Jaundice, CCF, Diabetes Mellitus, Ischemic Heart Disease, Stroke, Leukocytosis, increased SGOT, increased SGPT, Uremia, Large Size of Abscess, Multiple Liver Abscesses, Hepatomegaly and Ruptured Liver Abscess the hospital stay duration was longer and morbid.

## Introduction

Pyogenic liver abscesses are the most common liver abscesses and has been recognized since the time of Hippocrates.<sup>1</sup> Patients commonly present with right upper quadrant pain and fever. Jaundice occurs in up to one third of affected patients. Pyogenic liver abscess (PLA) is an uncommon but potentially life-threatening disorder with a crude annual incidence rate worldwide ranging from 2 to 45 cases per 1,00,000 hospital admissions.<sup>1-4</sup> In 1938, Ochsner et al. reported the first comprehensive case series of PLA, in which the case-fatality rate was 77%.<sup>5</sup> In the last two decades, the case-fatality rate has decreased to 6 to 26%.<sup>2,3,6-15</sup> They may be single or multiple and are more frequently found in the right lobe of the liver. The abscess cavities are variable in size and when multiple, may coalesce to give a honeycomb appearance. Approximately 40% of abscesses are mono-microbial, an additional 40% are poly-microbial, and 20% are culture-negative<sup>2</sup>. The most common infecting agents are gram-negative bacteria. *Escherichia coli* is found in two thirds of cases, and other common organisms include *Streptococcus faecalis*, *Klebsiella*, and *Proteus vulgaris*. Anaerobic organisms such as *Bacteroides fragilis* are also seen frequently. In patients with endocarditis and infected indwelling catheters, *Staphylococcus* and *Streptococcus* species are more commonly found. In the past, pyogenic liver abscesses often resulted from infections of the intestinal tract such as acute appendicitis and diverticulitis, which then spread to the liver via the portal circulation. With improved imaging modalities and earlier diagnosis of these intra-abdominal infections, this particular etiology of pyogenic liver abscesses has become less common. Pyogenic liver abscesses also occur as a result of impaired biliary drainage, subacute bacterial endocarditis, infected indwelling catheters, dental procedures, or the direct extension of infections such as diverticulitis or Crohn's disease into the liver. There appears to be an increasing incidence due to infection by opportunistic organisms among immune-

suppressed patients, including transplant and chemotherapy recipients as well as patients with acquired immunodeficiency syndrome (AIDS).

Due to the advent of newer sophisticated imaging modalities, early diagnosis and precise localization of pyogenic liver abscess can be achieved. Now-a-days, image guided percutaneous aspiration and drainage of abscess along with new generation of IV antibiotics has largely replaced more invasive surgical treatment as the first line therapy for pyogenic liver abscess. Although several attempts to identify predictors of mortality in PLA patients have been made, there is no consensus regarding which factors are proven. Reported prognostic factors for PLA include older age, high Acute Physiology And Chronic Health Evaluation (APACHE)II score, elevated counts of white blood cells, Blood Urea Nitrogen (BUN), serum creatinine, total bilirubin, low levels of serum albumin and globulin, septic shock, liver abscess of biliary origin, multiple abscesses, concomitant malignancy, and pleural effusion.<sup>1,3,4,6-9,12-15</sup> In some series, liver abscess is less likely to be fatal when caused by *Klebsiella pneumoniae* and is more likely to have an inert clinical course when caused by *Escherichia coli*.<sup>16,17</sup> Because previous reports of patients with PLA have seldom included bacterial characteristics, we will collect microbiological data and other clinical information from PLA patients to identify the prognostic factors for this condition. We will also investigate the clinical features, abscess characteristics, causative pathogens, treatments and outcomes in these patients over this study period.

## Material and Methods

This prospective study involved 150 patients who were admitted in male and female surgical wards, Department of General surgery, J.A. Group of hospitals and G.R. Medical College, Gwalior during period December 2017-August 2019 after taking well informed written consent from the patient.

**Inclusion Criteria**

- Age more than 15 years.
- Well Informed and written consent duly signed by patient and their attendants.

**Exclusion Criteria**

- Patient having age less than 15 years.
- Amoebic liver abscess.
- Patients with neurological symptoms.

**Method of Collection of Data**

We defined a case-patient as a patient with

1. Identification of one or more discrete abscess cavities in the liver by imaging studies- Abdominal Ultrasonography (US) and/or computerized axial tomography (CT) scans with contrast enhancement.

For each case-patient identified, we maintained records and studied demographic data, underlying medical conditions, clinical features, laboratory data, imaging and microbial findings and treatment along with duration of stay.

**Search for Underlying Etiology**

The underlying cause of PLA was investigated. PLA was considered secondary to benign biliary tract disorder in patients having gall stones and a clinical picture of cholecystitis / cholangitis / documented abnormality of hepatobiliary system was noted. PLA was ascribed to be secondary to haematological spread when a bacteremic episode with another source of infection was present. Portal phlebitis was considered to be the etiologic cause if there was any coexisting intra abdominal pathology like appendicitis, colitis, diverticulitis noted. PLA was said to be resulting from any hepatopancreatic malignancy if found at the same site or causing any biliary obstruction. CRYPTOGENIC abscess was defined when no source of any infection could be identified after all required investigations.

**Management Strategies**

The diagnosis of PLA was established by a assessment of clinical findings and imaging studies (USG, CT, Aspiration of pus from lesion). Initially, a broad spectrum antibiotic Ceftriaxone

1gm IV was given after initial sepsis workup from blood and/or pus aspirate was done. Percutaneous needle aspiration of liver abscess was done if abscess size was > 5 cm in diameter or there was clinical evidence of ongoing sepsis inspite of antibiotic treatment. The procedure was performed under real time USG guidance in radiology department. Needle aspiration was done using a 22 G Chiba needle under LA after taking well informed consent. The aspirated pus was sent for culture and sensitivity. This was followed by Pigtail 12 fr catheter placement for continuous drainage, unless drainage was not considered beneficial by attending radiologist. Surgical drainage was considered for those patients who failed to respond to IV antibiotics and percutaneous treatment or those who had concurrent intra abdominal pathology /rupture leading to intra abdominal abscess requiring laparotomy. The patient's clinical condition was closely monitored and follow up USG imaging was done to monitor the outcome /resolution /progression of the liver abscess.

**Statistical Analysis**

Descriptive data was summarized as means with standard deviations (SD's) for continuous data and as percentages for categorical data. Comparisons between groups for continuous variables were made using the Student's T test. Categorical variables were compared between groups using Pearson's chi square test, as appropriate. The relation between (a) demographic, clinical, imaging, microbiological, and laboratory factors and (b) duration of treatment were analyzed. The statistically significant independent factors were obtained by univariate analyses. The prognostic factors independently related to duration of treatment were then identified. Odds ratios (OR's) and their 95% confidence intervals (CI's) were calculated. Accordingly, p-values were calculated and analyzed.

## Results

From December 2017 to August 2019, 150 patients diagnosed with pyogenic liver abscess were admitted in Department of Surgery, G.R. Medical College, Gwalior.

**Table 1:** Age Distribution in patients with pyogenic liver abscess

Age group (years)	No. of Patients	Percent
≤ 20	8	5.3
21-30	27	18
31-40	34	22.7
41-50	31	20.7
51-60	29	19.3
61-70	18	12
71-80	2	1.3
<b>Total</b>	<b>150</b>	<b>100</b>

The mean age was 44 years (ranging from 16 to 80 years). The age group with the greatest number of patients was 31-40 years.

**Table 2:** Sex Distribution in patients with pyogenic liver abscess

Sex	No. of Patients	Percent
Male	140	93.3
Female	10	6.7
<b>Total</b>	<b>150</b>	<b>100</b>

Out of these 150 patients, 140 patients were male and 10 patients were female ranging from 16 to 80 years with male to female ratio 14:1.

**Table 3:** Clinical features of patients with pyogenic liver abscess

Sign and symptoms	No. of patients	Percent
Right upper quadrant pain	145	96.7
Fever with chills	111	74
Malaise	30	20
Anorexia	27	18
Jaundice	19	12.7
Diarrhea	15	10
Hepatomegaly	22	14.6

The mean duration of symptoms prior to admission was 5.2 days (median – 3 days, range 1-60 days). As shown in table 3 the most common presenting feature was right upper quadrant abdominal pain – 96.6% followed by fever with chills 74%.

**Table 4:** Co-morbidity in patients with pyogenic liver abscess

Number of co-morbidities	No. of patients	Percent
0	48	32
1	57	38
2	22	14.7
3	10	6.7
4	9	6
5	4	2.7
<b>Total</b>	<b>150</b>	<b>100</b>

Co-morbidities included hypertension, diabetes mellitus, old stroke, ischaemic heart disease and congestive heart failure. 48 (32%) patients had diabetes mellitus, 45(30%) patients had 2 or more co-morbid illness.

**Table 5:** History of Alcoholism in patients with pyogenic liver abscess

History of alcoholism	No. of Patients	Percent
Present	109	72.7
Absent	41	27.3
<b>Total</b>	<b>150</b>	<b>100</b>

History of alcoholism was present in 109 patients (72.7%) patients.

**Table 6:** Laboratory studies in patients with pyogenic liver abscess

Lab studies	No. of Patients	Percent
WBC > 1000/mm <sup>3</sup>	136	90.7
Serum albumin < 35 g/l	139	92.7
SGOT > 40 IU/l	92	61.3
SGPT >40 IU/l	72	48
Serum total bilirubin >2 mg%	19	12.7
Blood urea nitrogen > 45 mg%	34	22.7
Serum creatinine > 1.4 mg%	38	25.3

The most common laboratory finding was low serum albumin which occurred in 139 patients (92.7%) followed by leukocytosis in 136 patients (90.7%) increased SGOT in 92 patients (61.3%) and increased SGPT in 72 patients (48%). Total bilirubin was elevated in 19 patients (12.7%). Notably 131 patients (87.3%) had normal serum bilirubin level.

**Table 7:** Pus Culture in patients with pyogenic liver abscess

Pus culture	No. of Patients	Percent
Positive	101	67.3
Negative	49	32.7
<b>Total</b>	<b>150</b>	<b>100</b>

**Table 8:** Blood Culture in patients with pyogenic liver abscess

Blood culture	No. of Patients	Percent
Positive	55	36.7
Negative	95	63.3
<b>Total</b>	<b>150</b>	<b>100</b>

Culture from aspirate of liver abscess was positive in 101 patients (67.3%) of 146 patients who underwent image guided aspiration of liver abscess or surgical drainage. Blood culture was positive in 55 (36.7%) patients.

**Table 9:** Micro-organisms culture from patients with liver abscess

Organisms	Pus culture		Blood culture	
	No. of patients	%	No. of patients	%
E-coli	50	33.3	30	20
Klebsiella species	38	25	20	13.3
Anaerobes	9	6	4	2.7
Bacterioids	4	3	1	0.7
<b>Total</b>	<b>101</b>	<b>67.3</b>	<b>55</b>	<b>36.7</b>

The most common organism identified was E-coli (33.3% in pus culture and 20% in blood culture) followed by klebisella (25% in pus culture and 13.3% in blood culture). The anaerobes were present in 6% of pus culture and 2.7% of blood culture positive patients. Polymicrobials comprised 3.4% of isolates from blood culture and 9% isolates from pus culture.

### Radiological and anatomical features

**Table 10:** Location of abscess in patients with pyogenic liver abscess

Site	No. of Patients	Percent
Left	10	6.7
Right	129	86
Bilateral	11	7.3
<b>Total</b>	<b>150</b>	<b>100</b>

**Table 11:** Solitary or multiple in patients with pyogenic liver abscess

	No. of Patients	Percent
Single	129	86
Multiple	21	14
<b>Total</b>	<b>150</b>	<b>100</b>

**Table 12:** Size of the liver abscess in patients with pyogenic liver abscess

Size	No. of Patients	Percent
< 5 cm	1	0.7
5-10 cm	110	73.3
> 10 cm	39	26
<b>Total</b>	<b>150</b>	<b>100</b>

USG, as first line investigation, was done for all the 150 patients. Right lobe was involved in 129 patients (86%). Bilateral lobe involvement was seen in only 11 patients (7%).

Single abscess cavity was present in 129 patients (86%) while 21 patients (14%) had multiple abscess cavities.

Notably in 110 patients (73.3%) abscess cavity size was 5-10 cm and 39 patients (26%) had size > 10 cm while only 1 patient had < 5 cm of abscess cavity size.

**Table 13:** Intra Abdominal Pathology in patients with pyogenic liver abscess

Intraabdominal pathology	No. of Patients	Percent
Present	25	16.6
Absent	125	83.4
<b>Total</b>	<b>150</b>	<b>100</b>

**Table 14:** Type of Intraabdominal pathology in patients with pyogenic liver abscess

Type of Intraabdominal pathology	No. of Patients	Percent
Colitis	15	10
Calculus cholecystitis	5	3.3
Appendicitis	5	3.3
<b>Total</b>	<b>25</b>	<b>16.6</b>

Of the 150 patients, 25 patients (16.6%) had associated abdominal pathology. Most common was colitis (10%) followed by calculus cholecystitis (3.3%) and appendicitis (3.3%).

**Table 15:** Modes of Management in patients with pyogenic liver abscess

Mode of management	No. of Patients	Percent
Medical	4	2.7
Image guided drainage	137	91.3
Surgical drainage	9	6
<b>Total</b>	<b>150</b>	<b>100</b>

**Table 16:** Morbidity, treatment and outcome in patients with pyogenic liver abscess

Variables	Initial treatment					
	Medical (n=4)		Image guided drainage + Medical (n=137)		Surgical drainage + medical (n=9)	
	No.	%	No.	%	No.	%
Requirement of subsequent treatment	1	25	4	2.9	0	0
Relapse	2	50	10	7.2	0	0
Rupture of abscess	0	0	4	2.9	0	0
Death	0	0	0	0	2	22.2

Image guided drainage was done in 137 patients (91.3%). Out of which 4 (2.9%) developed peritonitis due to rupture into peritoneal cavity and were thus taken for open surgical drainage (Exploratory laparotomy. Medical treatment (Antibiotic alone) was given to 4 patients (2.6%), out of which 2 had relapse and 1 patient required image guided drainage. Surgical drainage was done in total of 9 patients (65). There were 2 deaths (1.3%).

Continuous catheter drainage was performed in 94 patients (of 137 patients) (68.6%). The mean duration of drainage was 12.6 days. A pig tail catheter was not inserted in 43 patients after percutaneous aspiration as the abscess was either too thick or the cavity collapsed after aspiration. The mean duration of hospital stay was approximately 18.6 days. Intravenous third generation Cephalosporin (Ceftriaxone 1 gm) was the commonest antibiotic used along with metronidazole and quinolones.

In order to find out the significant factors affecting the duration of treatment for resolution of liver abscess, we applied pearson chi-square test to the documented variables and duration of treatment. Following 'p' values and their significance were obtained.

Variable	Number of patients out of 150	Percentage	'p' value	Significant if 'p' value<0.05
Abdominal pain	145	96.7%	0.191	Insignificant
Fever	111	74%	0.304	Insignificant
Diarrhea	15	10%	0.160	Insignificant
Hepatomegaly	22	14.6%	0.000	Significant
Jaundice	19	12.7%	0.000	Significant
Congestive Cardiac Failure	7	4.7%	0.001	Significant
Hypertension	91	60.7%	0.073	Insignificant
Diabetes Mellitus	48	32%	0.000	Significant
Ischemic Heart Disease	23	15.3%	0.000	Significant
Stroke	16	10.6%	0.000	Significant
History of alcoholism	109	72.7%	0.666	Insignificant
Hypoalbuminemia	139	92.7%	0.388	Insignificant
Leukocytosis	136	90.7%	0.000	Significant
SGOT > 40 IU/L	92	61.3%	0.000	Significant
SGPT > 40 IU/L	72	48%	0.000	Significant
Urea > 45 mg%	34	22.7%	0.000	Significant
Creatinine> 1.4 mg%	38	25.3%	0.000	Significant
Size	-	-	0.000	Significant
Number of abscess	-	-	0.037	Significant
Presence of complication (ruptured liver abscess)	13	8.6%	0.000	Significant

From this study we identified the following independent factors affecting the prognosis of patients with pyogenic liver abscess with respect to duration of treatment-Jaundice, CCF, diabetes mellitus, ischemic heart disease, stroke, leukocytosis, increased SGOT, increased SGPT, uremia, large size of the abscess, multiple liver abscesses, hepatomegaly and presence of complication that is ruptured liver abscess.

### Discussion

Pyogenic liver abscess is a common disease in today's scenario. Incidence is expected to rise due to ageing population, increasing number of immunocompromised patients with chronic illnesses and increased detection with newer imaging techniques. Over the past few decades, we observed changing trends in etiology, diagnosis, bacteriology, treatment and outcomes of patients.

Before era of antibiotics, portal phlebitis from a bowel infection was most common cause of pyogenic liver abscess<sup>5</sup>. Since then the cause has shifted, first towards biliary tract disorders and more recently towards cryptogenic origin<sup>18</sup>. In this series, 125 patients (83.3%) had cryptogenic disease and only 25 patients had associated intra-abdominal pathology, most common being colitis (10%) as the cause of liver abscess.

The mean age of distribution of liver abscess in this series is 44 years, i.e. fifth decade of life, consistent with recent trend in increase in age of presentation of pyogenic liver abscess as noted in other series<sup>5,19,20</sup>. This is mainly because of changing etiology of liver abscess.

Intravenous empirical antibiotics give adequate coverage for these organisms. Reports from literature suggest that antibiotics alone, when administered for 4-6 weeks can be curative for a solitary abscess less than 5 cm in diameter, if a diagnostic USG guided aspiration is also done to ascertain the diagnosis and determine the antimicrobial sensitivity of the culture micro-organism.<sup>21</sup> Intravenous antibiotics were given to all the patients. The most commonly used

antibiotics were third generation IV cephalosporin with metronidazole. This regimen covered most of the identifiable organisms and has similar to regimens used in other centres.<sup>14,22</sup> for patients with community acquired liver abscess, the more effective regimen for empirical therapy is Amoxicillin - Clavulanic acid or Ampicillin - Sulbactam plus metronidazole to cover the usual bacteria (Enterobacteriaceae, Bacteroides spp., Enterococci) and possible Entamoeba histolytica. Cefuroxime and metronidazole is an alternative choice.

Mortality rate for liver abscess has fallen considerably over last few decades. Early diagnosis with prompt institution of treatment is pivotal in successful therapy. The development of and sophisticated radiological imaging, techniques have revolutionized the management of liver abscess. The mortality rate in this series was 1.3%, consistent with recent declining rates as noted in last few years<sup>23,24</sup>.

Most of the patients presenting in our institution were males (male: female ratio 14:1). Right upper quadrant pain (96.65) was the most common presenting symptoms followed by fever (74%). There is strong relation in patients with pyogenic liver abscess and history of alcoholism (present in 72.6%). 139 patients had low serum proteins while 14 patients had normal WBC count and 131 patients had normal serum bilirubin. Patient having such non specific clinical presentations poses a challenge for diagnosis and needs a high index of suspicion.

In 86% of patients, right lobe of liver was involved. Bilobar involvement as present in 11 cases (7.3%). This is consistent with previous studies showing right lobe involvement in most of the cases. Similarly 86% patients had solitary liver abscess consistent with previous studies.

Based on classic work by Ochsner et al in 1938, open surgical drainage had been the recommended treatment historically<sup>5</sup>. However such an invasive technique requires general anaesthesia and was associated with surgical morbidity and mortality upto 70% in those times<sup>5</sup>. McFadzean et al in

Hong Kong reported the first experience of closed aspiration and antibiotic treatment of solitary liver abscess in 1953.<sup>25</sup> In their series, 14 patients underwent direct aspiration and antibiotics were immediately added to the cavity after irrigation. All patients had uncomplicated recovery. That report was largely ignored until 2 decades later. However with development of ultrasonography and CT scan, image guided drainage of liver abscess coupled with antibiotics is preferred treatment these days<sup>9,26,27</sup>. In this series, image guided drainage was done in 137 patients (91.3%). Surgical drainage was required only 9 patients (6%) while 4 patients (2.6%) were managed by antibiotics alone.

In this study, we could identify septicemia, hyperbilirubinemia, uraemia, increased size, deranged LFT, multiple abscess, ruptured liver abscess, emergency laparotomy and presence of comorbidities such as CCF, diabetes mellitus, IHD and stroke as important risk factors for poor outcome, morbidity and mortality in patients with pyogenic liver abscess consistent with studies in past<sup>9,28</sup>.

### Conclusion

In recent scenario, we mainly treat pyogenic liver abscess with a combination of parenteral antibiotics and USG guided percutaneous drainage with /without a pigtail catheter. Patients who are treated with antibiotics only are the ones having the abscess cavity size less than 5 cm. In pyogenic liver abscess patients having Jaundice, CCF, Diabetes Mellitus, Ischemic Heart Disease, Stroke, Leukocytosis, increased SGOT, increased SGPT, Uremia, Large Size of Abscess, Multiple Liver Abscesses, Hepatomegaly and Ruptured Liver Abscess the hospital stay duration was longer and morbid.

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