



## ORIGINAL ARTICLE

### CLINICAL PROFILE AND FACTORS AFFECTING OUTCOME OF FILIPINO CHILDREN WITH HEPATIC ABSCESS: 19 YEAR STUDY

#### ABSTRACT

**Objectives:** To describe the clinical profile of children with hepatic abscess, determine their laboratory & imaging findings, medical and surgical treatments and study factors affecting its outcome.

**Methodology:** A retrospective cohort study done in December 2016 on children 0 to <19 years old with a diagnosis of hepatic abscess on imaging from 1997-2015. Demographic, clinical and diagnostic data were correlated with the outcome and presence of complications.

**Results:** Thirty cases were identified in 19 years but only 25 charts were available for review. Mean age in years was 5.27 +/- 4.80 SD with male predominance. Fever (96%) and abdominal pain (60%) were common symptoms. Only 9 patients had hepatic abscess culture with *Staphylococcus aureus* (56%) as the most frequent growth. Anemia (76%) and leukocytosis (96%), and solitary (76%), large abscess >5 cms (60%) involving the right lobe (72%), were the common diagnostic findings. Most were treated with antibiotics alone (60%). All patients improved with no mortality noted, while pleural effusion was seen in 8 out of 12 patients with complications. Only male gender was significantly associated with complications both on chi-square (p 0.004) and logistic regression (p 0.008).

**Conclusion:** Hepatic abscess is a liver infection usually seen among young and male population, manifesting as fever with anemia and leucocytosis. Most were complicated by pleural effusion with no deaths reported. Male gender had significant association with complications.

**KEYWORDS:** *hepatic/liver abscess, Staphylococcus aureus, deep-seated infection*

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## INTRODUCTION

Hepatic abscess is an encapsulated collection of suppurative material within the liver parenchyma resulting from bacterial, fungal or parasitic microorganisms<sup>1</sup>. Children have a unique set of predisposing causes for hepatic abscess that include parasitic and skin infections, genetic conditions, malnutrition, abdominal infections and trauma<sup>2</sup>. Although its prevalence is higher among adults than children, this pathology is relevant because of its associated mortality, which ranges from 2 to 12%<sup>3</sup>. Because hepatic abscess presents with nonspecific symptoms, it can be quite difficult to diagnose in a timely manner<sup>1</sup>.

There are limited studies on the prevalence of hepatic abscess among children. In India, Chaubey, et al reported 32 cases of liver abscess in children over 5 years<sup>4</sup>. Meanwhile, in Saudi Arabia, 18 cases have been reported by Salahy et al in 10 years<sup>5</sup>, and Ba et al described 26 cases over 5 years<sup>6</sup> in Senegal. In our country, the latest data by Baclayon, et al in 1995, reported 45 pediatric cases in a 7-year period following a report of 87 combined cases of adult and children from the Philippine General Hospital between 1985-1991 by Manalo, et al<sup>7</sup>. On the other hand, the Philippine Society of Pediatrics registered about 80 cases of hepatic abscess, specifically amoebic in origin, out of 4,200,445 cases from 1997 to 2015<sup>8</sup>.

Availability of local data on pediatric hepatic abscess is limited, thus this paper aims to describe the profile of Filipino children diagnosed with hepatic abscess, and establish possible factors affecting their outcome. Information on their demographics, clinical presentation, diagnostic, laboratory characteristics and microbial etiology will enable us to possibly develop a more systematic approach to its diagnosis leading to an early and appropriate management, proper allocation of medical resources and anticipation of outcomes and

possible complications that may warrant aggressive monitoring and management.

## OPERATIONAL DEFINITIONS

**Hepatic abscess** – clinical findings of fever, abdominal pain or right upper quadrant mass supported by findings of abscess on ultrasonography or computed tomography (CT) scan, which may or may not be bacteriologically confirmed.

**Comorbid factors / condition** – any previous or newly diagnosed illness, or any identified conditions that could have incited the development of hepatic abscess like immunocompromised state, diabetes mellitus, cancer, postsurgical, history of skin/parasitic infection, post trauma and others.

**Clinical manifestations** – clinical symptoms of patients with hepatic abscess prior to admission

**Time to diagnosis** – the time from the patient's first clinical manifestation to the time a diagnosis by Ultrasound or CT Scan was established

**Time to resolution of symptoms** – the time from the initiation of treatment to the resolution of the initial presenting symptom such as fever, abdominal mass or abdominal pain

**Complications** – development of pleural/pericardial effusion, basilar infiltrates, concomitant or extension of abscess in adjacent or distant sites, hepatopulmonary/ hepatobronchial fistula, rupture, peritonitis, perforation of hollow viscus, ascites, sepsis/septic shock, with or without improvement and others.

### Outcome

**Cured** – disappearance of symptoms with resolution of abscess on repeat imaging

**Improved** – disappearance of symptoms with no complete resolution or without progression of abscess on repeat imaging

**Mortality** – resulting in death

**Anemia** – as defined by the World Health Organization hemoglobin concentration by age<sup>9</sup>

**Nutritional status** – following the classification in the World Health Organization growth chart

**Liver function tests:**

Prolonged prothrombin time – >2 seconds from the control<sup>10</sup>

Elevated SGPT/ ALT- 3x the upper limit of normal<sup>11</sup>

Elevated alkaline phosphatase from the upper limit of normal<sup>11</sup>

Elevated ESR - > 20 mm/hr<sup>11</sup>

Cholestasis – direct bilirubin more than 20% of the total if the total bilirubin is >5mg/dL, or direct bilirubin more 1 mg/dL if total bilirubin is less than 5mg/dL<sup>12</sup>

## MATERIALS AND METHODS

This is a retrospective cohort study done among all children 0 to less than 19 years old diagnosed with hepatic abscess by either ultrasonography or CT scan admitted in a tertiary medical center from January 1997 to December 2015.

### Study Procedure

Convenience sampling or non-probability sampling was done through the records section database wherein charts of all admitted children diagnosed with hepatic abscess were reviewed. The data collection form was submitted to the Ethics Review Board of our institution prior to the conduct of the study. Confidentiality of the records was observed all throughout the research period. The principal investigator had no conflict of interest in doing the study.

### Data Processing and Data Analysis

Descriptive data as means with standard deviations (SDs) was used for continuous data and as percentages for categorical data. The demographic, clinical, diagnostic imaging, microbiological, laboratory values and treatment

done were analyzed in association with the presence of complications and outcomes. Statistically significant independent factors by univariate analyses were analyzed using logistic regression model. Prognostic factors independently related to mortality or complications were identified with odds ratios (ORs) and their 95% confidence intervals (CIs). Statistical software used in processing the data was Stata Statistical Software: Release 14 (StataCorp. 2015. College Station, TX: StataCorp LP)

### Data Collection and Outcome

The principal investigator reviewed all the charts of patients with hepatic abscess wherein the following variables were obtained. Age, stratified into infancy, childhood and adolescent as follows: 0-2 years old, 3-9 years old, 10-18 years old; gender as to either male or female; nutritional status as either severe, moderate or no malnutrition, overweight or obese; co-morbid conditions as to presence of trauma, parasitism, skin lesions, chronic conditions and others; clinical manifestations as to the presence of fever, abdominal pain, abdominal mass, jaundice, vomiting, diarrhea and others; time to diagnosis; time to resolution of symptoms. Laboratory tests done and results (Hemoglobin, WBC, Prothrombin time, Alanine aminotransferase, Alkaline phosphatase, Bilirubin, ESR) as well as microbiologic isolates (hepatic abscess culture and blood culture) were noted. Ultrasound and/or CT scan findings were classified as to size, lobe involvement and number of abscess. Treatment management was described as either using medical therapy alone with what antibiotics or medical therapy with surgical intervention. The length of hospital stay, presence of rupture, pleural effusion, extension, fistula, peritonitis, perforation as complications, as well as the patients' outcome as either improved, cured or died were likewise noted.

The association between these mentioned variables with complications and outcome were analyzed.

## RESULTS

### Demographic and Clinical Profile

There were 30 patients admitted from January 1997-December 2015 with a diagnosis of hepatic/ liver abscess by imaging. However, only 25 charts were available for review. Efforts to retrieve all 30 charts were done however the records section was not able to provide the complete files. Forty percent (10/25) of patients belonged to the 3-9 years age group (Table 1). Mean age in years was 5.27 +/- 4.80 SD. There was predominance of male subjects at 60% (15/25) with a male to female ratio of 1.5:1. Malnutrition was noted in 56% (14/25) of patients. There were co-morbid conditions in 24% (6/25) of subjects, the most common of which was intestinal parasitism in 67% (4/6), followed by pulmonary tuberculosis in 33% (2/6), and skin lesion (gluteal abscess) in 17% (1/6). Mean time to

diagnosis was 22 days (range: 4-120 days) and the mean time for symptom resolution was 34 days (range: 4-122 days). The rest of the clinico-demographic profile is listed in Table 1.

### Clinical Manifestations

The most common manifestation was fever, as seen in 24 patients (96%), followed by abdominal pain seen in 15 patients (60%). The one patient who did not present with fever was a one month old, severely malnourished infant with a right upper quadrant mass. Among patients with fever, about 63% (15/24) had one associated symptom other than fever, while 25% (6/24) had two or more associated symptoms with fever. Only 12% (3/24) had fever as the only manifestation. Two (8%) had cough and 2 (8%) other patients had difficulty of breathing, all of them had complications of pleural effusion. There was one patient (4%) who developed diarrhea characterized as loose to watery, non-bloody and non-mucoid with the no note of amoeba or parasites on stool exam.

**TABLE 1: CLINICO-DEMOGRAPHIC PROFILE OF SUBJECT PARTICIPANTS**

DEMOGRAPHIC / CLINICAL PROFILE	TOTAL N= 25
Age	
0-2 years old	9 (36%)
3-9 years old	10 (40%)
10-18 years old	6 (24%)
Gender	
Male	15 (60%)
Female	10 (40%)
Comorbid condition	
Present	6 (24%)
Absent	19 (76%)
Nutritional status	
Normal	10 (40%)
Moderate Malnutrition	7 (28%)
Severe Malnutrition	7 (28%)
Obese	1 (4%)

### Laboratory tests

Anemia<sup>9</sup> was seen in 76% of patients (19/25) with a median hemoglobin level of 96 g/L (range 39 -135 g/L). Ninety six percent of patients (24/25) had leukocytosis having a median white cell count of  $19.35 \times 10^9/L$  (range 10 -  $44.9 \times 10^9/L$ ). Prothrombin time was done in 20 patients (80%) only, with 8 of them (40%) having prolonged results<sup>10</sup>. Alanine aminotransferase levels were determined in 19 patients (76%) with only one (5%) elevated result (3x the upper limit)<sup>11</sup>. Out of 9 patients (36%) with alkaline phosphatase level, only one (11%) was increased (2.7x the upper limit)<sup>11</sup>. There were 9 patients (36%) who had total bilirubin levels of < 5 mg/dl, two (22%) of which were cholestatic<sup>12</sup>, with no visible ictericia nor jaundice. Erythrocyte sedimentation rate (ESR) was done in 7 patients (28%) with 6 of them showing elevated results<sup>11</sup>.

### Microbiologic tests

Blood culture and hepatic abscess cultures were done in 76% (19/25) and 36% (9/25) of cases, respectively. Twenty one percent (4/19) had positive growth on blood cultures only while 56% (5/9) yielded positive growth on hepatic abscess cultures, all of which were *Staphylococcus aureus* isolates (Table 2). No tests were done in any of them to confirm an amoebic cause for the abscesses.

### Imaging

Ultrasound alone was done in 36% (9/25) of patients while both ultrasound and CT scan imaging were done in 64% (16/25) of patients which showed the same characteristics of hepatic abscess. The most commonly seen features were abscess size of > 5 cms in 60% of cases (15/25), solitary abscess in 76% (19/25), with 72% (18/25) involving the right hepatic lobe.

**TABLE 2: MICROBIOLOGIC TESTS AND RESULTS**

Microbiologic tests	Results (n/%)
Blood culture done	19 (76%)
Positive growth	4 (21%)
- <i>Klebsiella pneumoniae</i>	1 (25%)
- <i>Burkholderia cepacea</i>	1 (25%)
- <i>Enterobacter aerogenes</i>	1 (25%)
- <i>Serratia marcescens</i>	1 (25%)
No growth	15 (79%)
Not done	6 (24%)
Hepatic abscess culture done	9 (36%)
Positive growth	5 (56%)
- Methicillin resistant <i>Staphylococcus aureus</i> (MRSA)	2 (40%)
- Coagulase positive <i>Staphylococcus aureus</i> (COPS)	3 (60%)
No growth	4 (44%)
Not done	16 (64%)

### Complications

Complications arising from hepatic abscess were observed in 12 patients (48%), most commonly pleural effusion, as seen in 8 (67%) patients, followed by extension in contiguous areas in 4 (33%) patients. Other less common complications were peritonitis noted in 3 (25%) cases and rupture of abscess in 2 cases (17%).

### Treatment

All patients were empirically started on broad spectrum intravenous antibiotics upon diagnosis of hepatic abscess. Seventy two percent of cases (18/25) used the antiprotozoal metronidazole in combination with antibiotics such

as oxacillin (40%), gentamicin (32%), third generation cephalosporin (25%) and/or ampicillin (16%). Antibiotics were changed when no clinical improvement was seen, upon worsening of the patients' conditions and/or according to the sensitivities of organisms cultured, usually to vancomycin (33%), piperacillin-tazobactam (33%) or clindamycin (33%). Clindamycin (43%) was the usual stepdown oral antibiotic on discharge, followed by ciprofloxacin (33%) and cloxacillin (24%), with or without metronidazole.

Sixty percent (15/25) of patients were treated with antibiotics alone while 40% (10/25) used antibiotics and surgical decompression. Only 47% (7/15) among those who had large abscess size > 5 cms were managed surgically with antibiotics, while the remaining 53% (8/15) were treated with antibiotics alone. Open drainage was the surgical technique employed in 57% (4/7) of those with abscess size of > 5 cms, while 67% (2/3) of hepatic abscess size ≤ 5 cms were drained percutaneously.

Among patients who were given antibiotics alone, 73% (11/15) stayed in the hospital for less than 1 month, while 27% (4/15) stayed for more than a month. Among patients managed medically and surgically, only 20% (2/10) stayed for more than a month while 80% (8/10) were discharged within a month or less.

#### Outcome and Length of Hospital Stay

Overall, 19 patients (76%) stayed in the hospital for 1 month or less while 6 (24%) stayed for

more than 1 month. All patients had improved outcome after a mean length of 25 hospital days (range: 5-60 days) with no mortality. None were considered cured since only decrease in size without complete resolution of the abscess, was documented in all patients on repeat imaging.

#### ASSOCIATION OF VARIABLES WITH OUTCOME AND COMPLICATIONS

Since all patients had improved outcome, only the analysis of variables with the presence or absence of complications was done. Complications were common in 83% (5/6) of patients aged 10-18 years old, in half (50%) of all malnourished patients, among those without co-morbid conditions (53%) and among those who were diagnosed early within less than 2 weeks (Table 3). Eleven (92%) patients with complications were also noted to be male. Similarly, 73% (11/15) of all male patients developed complications. Fisher exact test showed significant result when gender was analyzed with the development of complications (p 0.004). Logistic regression on gender showed significant difference (p 0.008), with the odds of female patients having complications from hepatic abscess at 96% (1-0.4) less than male patients (Table 4). Meanwhile, no significant differences were established between the age group, presence of co-morbidities, nutritional status, as well as time to diagnosis, and the presence of complication (Table 3).

**TABLE 3: ASSOCIATION OF DEMOGRAPHIC AND CLINICAL VARIABLES WITH DEVELOPMENT OF COMPLICATIONS FROM HEPATIC ABSCESS**

DEMOGRAPHIC / CLINICAL PROFILE	WITH COMPLICATIONS n=12	WITHOUT COMPLICATIONS n=13	TOTAL N= 25	P value
Age	3 (33%)			
0-2 years old	4 (40%)	6 (67%)	9 (36%)	<b>0.16</b>
3-9 years old	5 (83%)	6 (60%)	10 (40%)	

10-18 years old		1 (17%)	6 (24%)	
Gender				<b>0.004</b>
Male	11 (73%)	4 (27%)	15 (60%)	
Female	1 (10%)	9 (90%)	10 (40%)	
Co-morbid condition				<b>0.64</b>
Present	2 (33%)	4 (67%)	6 (24%)	
Absent	10 (53%)	9 (47%)	19 (76%)	
Nutritional status				<b>1.00</b>
Normal	5 (50%)	5 (50%)	10 (40%)	
With malnutrition	7 (50%)	7 (50%)	14 (56%)	
Moderate Malnutrition	4 (57%)	3 (43%)	7 (28%)	
Severe Malnutrition	3 (43%)	4 (57%)	7 (28%)	
Obese	0 (0%)	1 (100%)	1 (4%)	
Time to diagnosis				<b>0.34</b>
< 2 weeks	7 (58%)	5 (42%)	12 (48%)	
≥ 2 weeks	5 (38%)	8 (62%)	13 (52%)	

**TABLE 4: LOGISTIC REGRESSION ANALYSIS OF GENDER IN ASSOCIATION WITH HEPATIC ABSCESS COMPLICATIONS**

	Odds Ratio	P> z	[95% Conf. Interval]
<b>Gender</b>			
Male			
Female	.040404	<b>0.008</b>	.0038083 .4286679

Fifty eight percent of the group with complications (7/12) took 2 weeks to 1 month for symptom resolution while 83% percent (10/12) of those with complications, stayed in the hospital for less than a month. No statistical significance was noted between these two variables and having complications (p 0.32, p 0.64, respectively).

Fever with one associated symptom was a frequent finding in 58% (7/12) of complicated hepatic abscess. On further subanalysis, it was demonstrated that large abscesses size > 5 cms were common among patients having fever with 1 or 2 associated symptoms (73% and 67% respectively), and all who presented with fever alone (100%) had abscess size of

< 5 cms. However, the clinical manifestations had no significant association with complications (p 0.71), and the abscess size (p 0.11).

Complications were seen in 7 patients (37%) with anemia and in 12 patients (50%) with leukocytosis (Table 5). Elevated white cell counts were found among all complicated hepatic abscesses. Similarly, no significant difference was seen between the occurrence of complications and the findings of anemia (p 0.07) and leukocytosis (p 1.00) on CBC.

Growth positivity to hepatic abscess culture and blood culture in association with complications, likewise, did not show any significant difference with p values of 1.0 and 0.60, respectively (Table 5).

**TABLE 5. ASSOCIATION OF LABORATORY RESULTS WITH DEVELOPMENT OF COMPLICATIONS FROM HEPATIC ABSCESS**

Laboratory Profiles	WITH COMPLICATIONS n=12	NO COMPLICATIONS n=13	TOTAL N=25	P value
Anemia				
Present	7 (37%)	12 (63%)	19 (76%)	0.07
Absent	5 (83%)	1 (17%)	6 (24%)	
Leukocytosis				
Present	12 (50%)	12 (50%)	24 (96%)	1.00
Absent	0 (0%)	1 (8%)	1 (4%)	
HEPATIC ABSCESS CS				
Positive	3 (60%)	2 (40%)	5 (20%)	1.00
No growth	2 (50%)	2 (50%)	4 (16%)	
Not done	7(58%)	9 (70%)	16 (64%)	
BLOOD CS				
Positive	3 (75%)	1 (25%)	4 (16%)	0.60
No growth	8 (53%)	7 (47%)	15 (60%)	
Not done	1 (17%)	5 (83%)	6 (24%)	

**TABLE 6. ASSOCIATION OF DIAGNOSTIC RESULTS WITH COMPLICATIONS FROM HEPATIC ABSCESS**

CHARACTERISTICS OF HEPATIC ABSCESS ON IMAGING	WITH COMPLICATIONS n=12	NO COMPLICATIONS n=13	TOTAL N=25	P value
Abscess size				
≤ 5 cms	4 (40%)	6 (60%)	10 (40%)	0.69
>5 cms	8 (53%)	7 (47%)	15 (60%)	
Hepatic lobe involvement				
Right	11 (61%)	7 (39%)	18 (72%)	0.09
Left	1 (33%)	2 (67%)	3 (12%)	
Right and left	0 (0%)	4 (100%)	4 (16%)	
Number of abscess				
Solitary	10 (83%)	9 (31%)	19 (76%)	0.64
Multiple	2 (17%)	4 (69%)	6 (24%)	

Eight (67%) of the complicated cases had abscess size of > 5 cms, with 11 (92%) complicated cases having right hepatic lobe involvement and 10 (83%) being solitary (Table 6). Among the different imaging characteristics analyzed, none were found to

have significant association with complications having p values of 0.69, 0.09 and 0.64, for the size, lobe involvement and number of abscess, respectively. In this study, half of the patients with complications (6/12) were treated with antibiotics alone and half



(6/12) were managed using surgical drainage aside from antibiotics. Four out of thirteen (31%) patients without complications were treated with both antibiotics and surgical decompression. No statistical difference was demonstrated between the development of complications and the mode of treatment applied (p 0.43).

## DISCUSSION

Hepatic abscess is a frequently encountered condition in tropical and subtropical zones<sup>13</sup> like the Philippines. However, our data shows that its occurrence in children is quite rare. It affects the younger population especially males<sup>14</sup>, and the earlier age trend among patients from developing countries may be due to earlier contact with infection<sup>5</sup>. Similarly, in this study, the mean age in years was 5.27 +/- 4.8 SD with male predominance. Although male susceptibility was described mostly for adults, male children, likewise, are affected more than females<sup>2</sup>. This male predominance may be explained by a study in mice where activation of natural killer T cell-producing interferon gamma, important for liver abscess control, is influenced by the inhibiting effect of testosterone<sup>15</sup>.

Children have distinctive set of predisposing causes for hepatic abscess. Co-morbid conditions similar to the findings of one study<sup>16</sup> like intestinal parasitism, pulmonary tuberculosis and skin infection were observed in 24% of our cases, with malnutrition in 56% of patients. Trauma, which is also a commonly reported factor, however, was not reported in our patients.

Fever in hepatic abscess usually presents as fever of unknown origin<sup>1,16</sup>. Two studies described fever and abdominal pain as the most frequent symptoms in hepatic abscess<sup>5,17</sup>, which were consistent in this study.

There were limitations in the laboratory findings from this study since only complete blood

count was common to all patients. The anemia and leukocytosis seen in our patients, were also noted by Mishra, et al, regardless of etiology of hepatic abscess<sup>13</sup>.

About 2/3 of cases of hepatic abscess in developing countries are amoebic in origin and ¼ of cases in developed countries are pyogenic<sup>13</sup>. The predominant organism cultured from our patients' hepatic abscesses was *Staphylococcus aureus*, which is the most common pyogenic cause in children<sup>14</sup>, in contrast to *Escherichia coli* and *Klebsiella pneumonia* in adults<sup>18,19</sup>. Likewise, there was monomicrobial growth in blood culture of our patients with *Staphylococcus aureus*. An adult study in 2011 reported a polymicrobial cause for hepatic abscess<sup>20</sup>. In our case, 64% of patients had no definitive diagnosis from hepatic abscess culture. Sensitive markers for amoebic infection like indirect hemagglutination assay or enzyme immunoassay are not commonly used in our setting because of limited availability and high cost. Hence, the possibility of an isolated pyogenic, or a concomitant amoebic cause for hepatic abscess in our patients cannot be confirmed.

Both amoebic and pyogenic hepatic abscesses are frequently identified in the right lobe<sup>14</sup>. While pyogenic abscesses can be both solitary and multiple, solitary abscesses are mostly amoebic in origin<sup>14,21</sup>. We found a predominance of solitary and large ( $\geq 5$  cms) abscesses mostly involving the right lobe among our patients. The latter finding is due to the greater volume of the right lobe and streaming effect of portal venous blood flow<sup>3</sup>.

Amoebic liver abscess is the most common extraintestinal site of amoebic infection but occurs only in <1% of *Entamoeba histolytica* infections. It usually presents with fever, with ~ 10-20% having past history of diarrhea or dysentery. Upper abdominal pain is usually intense and constant and its cardinal sign is tender hepatomegaly. Indirect

hemagglutinin assay is the most sensitive test (90%)<sup>22</sup>, however, this has been replaced by the more commercially available Enzyme Immunoassay (EIA) test kits for routine serodiagnosis of amoebic infections<sup>23</sup>. However, in our clinical setting, it is not readily available and costly hence, empiric treatment for both pyogenic and amoebic causes becomes an option.

The standard management for both pyogenic and amoebic hepatic abscess, was observed among our patients. A two-week systemic antibiotic therapy followed by a four-week course of appropriate oral agent plus metronidazole for 10 days was the usual regimen seen in our study. There has been much debate over the role of either percutaneous or open surgical drainage. In addition to abscess size, other criteria for percutaneous drainage include: continued fever after 2-3 days of adequate medical treatment, and clinical or ultrasonographic features suggest impending perforation<sup>24</sup>. Insertion of a drainage catheter was more effective for abscesses larger than 5 cm<sup>25</sup>, requiring fewer secondary procedures, and achieved higher rates of resolution<sup>26</sup>. Sixty percent of our patients were treated conservatively with antibiotics alone, 53% of whom had abscess size of > 5 cms. Majority of those who underwent percutaneous drainage had abscess size  $\leq$  5 cms, while those which were drained openly were > 5 cms in size. Records did not clearly state why some patients underwent surgical intervention and others did not.

All patients had improved outcome, with an average of 34 days for symptom resolution and an average of 25 hospital days. The prolonged hospital stay and symptom resolution observed were confounded by factors such as missed doses of antibiotics, delay in facilitating diagnostics, or even delay in hospital discharge for socioeconomic reasons.

Mortality rates were reported to be as high as 36%, although they have decreased in more recent publications<sup>5,7,27</sup>. The absence of mortality in our study probably reflects the early diagnostic and therapeutic interventions as well as the targeted and prolonged intravenous antibiotic therapy, similar to the findings of Tsai, et al<sup>27,28</sup>. Another reason may possibly be due to the etiology of the abscess.

Intraperitoneal rupture with peritonitis, hepatopleural or hepatobronchial fistulae and pericardial extension are the common complications noted<sup>13</sup>. Pleuropulmonary complications, ascites, peritonitis, septic shock, and, rarely, perforations also occur<sup>17,29</sup>. The most common complication encountered in this study was pleural effusion.

There are few studies done among children on factors affecting complications and outcome in hepatic abscess. Patient's age, multiplicity of abscesses and organisms, and presence of immunosuppressive conditions were some of the poor prognostic factors identified for morbidity and mortality<sup>30</sup>. Among the factors analyzed in this study, only male gender had significant difference in the occurrence of complications from hepatic abscess. This finding was not demonstrated in other studies and in our case, may be explained by the predominance of male subjects with hepatic abscess.

## CONCLUSION & RECOMMENDATIONS

Hepatic abscess was identified in 25 pediatric cases within 19 years, commonly in younger and male group. Fever was the most common presentation and, anemia and leukocytosis were frequent laboratory findings. There were only a limited number of patients who had hepatic abscess culture, in which, *Staphylococcus aureus* was the most common organism isolated, however, a concomitant amoebic cause cannot be ascertained. Majority of the abscesses on imaging were solitary, > 5 cms in size involving the right lobe. All had improved outcome

with no mortality noted, but with complications that included pleural effusion, extension, peritonitis and rupture. Only male gender was found to be statistically significant as a factor for developing complications.

Prospective studies with determination of specific etiologic cause (pyogenic or amoebic) of hepatic abscess in children and the efficacy of the different treatment modalities are recommended. Evaluation of the need for CT scan for its diagnosis is likewise recommended. Long-term outcome of children who have had hepatic abscess is likewise an important aspect to look into.

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